COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 08-1

NSF 08-548 **06/10/08**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

IIP - SMALL BUSINESS PHASE I

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

0839294

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Not Shown

SHOW PREVIOUS AWARD NO. IF THIS IS
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IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☒ SMALL BUSINESS ☐ MINORITY BUSINESS
☒ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **SBIR Phase I:ManyWheels VehicleTransport Optimization**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **100,000**	**4** months	**01/01/09**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C)
☒ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ SMALL GRANT FOR EXPLOR. RESEARCH (SGER) (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.5) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____
☐ HUMAN SUBJECTS (GPG II.D.6) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____
☐ HIGH RESOLUTION GRAPHICS/OTHER GRAPHICS WHERE EXACT COLOR REPRESENTATION IS REQUIRED FOR PROPER INTERPRETATION (GPG I.G.1)

PI/PD DEPARTMENT

[redacted]

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Electronic Mail Address
PI/PD NAME				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

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NATIONAL SCIENCE FOUNDATION
Program Solicitation/Instruction Guide Number **NSF 08-548**

SBIR PHASE I - PROPOSAL COVER PAGE

TOPIC	SUBTOPIC LETTER (if any)	TOPIC TITLE
SS	**A2**	**Software and Services**

PROPOSAL TITLE **SBIR Phase I:ManyWheels VehicleTransport Optimization**

COMPANY NAME	EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)
[redacted]	[redacted]

NAME OF ANY AFFILIATED COMPANIES (Parent, Subsidiary, Predecessor)

ADDRESS (Including address of Company Headquarters and zip code plus four digit extension)
[redacted]

REQUESTED AMOUNT	PROPOSED DURATION	PERIOD OF PERFORMANCE
$100000	**4**	

THE SMALL BUSINESS CERTIFIES THAT:	**Y/N**
1. It is a small business as defined in the solicitation.	**Y**
2. It qualifies as a socially and economically disadvantaged business as defined in the solicitation. (FOR STATISTICAL PURPOSES ONLY.)	**N**
3. It qualifies as a women-owned business as defined in the solicitation. (FOR STATISTICAL PURPOSES ONLY)	**N**
4. NSF is the only Federal agency that has received this proposal (or overlapping or equivalent proposal) from the small business concern. If No, you must disclose overlapping or equivalent proposals and awards as required by this solicitation.	**Y**
5.SBIR: A minimum of two-thirds of the research will be performed by this firm in Phase I. STTR: It will perform at least 40 percent of the work and the collaborating research institution will perform at least 30 percent of the work as described in the proposal.	**Y**
6. The primary employment of the Principal Investigator will be with this firm at the time of the award and during the conduct of the research.	**Y**
7. It will permit the government to disclose the title and technical abstact page, plus the name, address and telephone number of a corporate official if the proposal does not result in an award to parties that may be interested in contacting the small business for further information or possible investment.	**Y**
8. It will comply with the provisions of the Civil Rights Act of 1964 (P.L. 88-352) and the regulations pursuant thereto.	**Y**
9. It has previously submitted proposals to NSF.	**N**
10. It previously submitted this proposal (which was declined) and significant modifications have been made as described in the solicitation.	**N**
11. It has received Phase II awards from the Federal Government. If "yes" provide a company commercialization history in the supplementary documents module.	**N**
12. It is located in a Historically Underutilized Business Zone (HUBZone) as verified by the Small Business Administration [redacted]	

[redacted]

PROPRIETARY NOTICE: See instructions concerning proprietary information.
Check Here ☒ if proposal contains proprietary information.

MANYWHEELS PROJECT SUMMARY

This Small Business Innovation Research Phase I project will pursue a solution to the inefficiencies in transporting automobiles. This project is partnership that leverages:

- Industry expertise and demand validation by a large company in the automobile market,
- The technology and research capabilities of The National Science Foundation's Industry/ University Cooperative Research Program (I/UCRC), and
- The innovation and speed of experienced leaders in the entrepreneurial technology community.

INTELLECTUAL MERITS OF THE PROPOSED ACTIVITY

80 million new and used vehicles are sold annually in the US in a rich, dynamic market involving manufacturers, dealers, wholesalers, consumers, banks, rental agencies, and others. In spite of the sophistication and size of this market, the transportation of these vehicles from seller to intermediary to buyer operates inefficiently, often using technology and business processes that pre-date the Internet. Commercial automobile transporters frequently drive routes with spare capacity or empty trucks because they cannot identify and secure new business opportunities in real time.

This project will improve the efficiency of transporting automobiles by developing market-mechanisms to allow shippers and transporters to discover and negotiate opportunities in real time. Creating such a market requires solving a real-time logistics problem in an enormous, highly fractured market of thousands of businesses shipping millions of pieces of cargo among 10,000 transporters which often have limited communications infrastructure beyond PDAs and cell phones.

BROADER IMPACTS AND COMMERCIAL POTENTIAL OF THE PROPOSED ACTIVITY

The demand for this solution (as well as technology and market challenges) has been confirmed by large potential customers with expertise in the business. Billions of dollars are spent annually transporting automobiles; the potential for even single-digit efficiency improvements creates a compelling business opportunity. The company that can achieve such improvements may benefit from the scalability and network effects that create attractive investment opportunities for venture capitalists. The financial model also improves with rising fuel prices.

Additionally, the solution will have the strategic benefit to the US of reducing our oil consumption. It will also have the social benefit of reducing the US carbon footprint. A 10% efficiency improvement in automobile transportation in just one market segment will have the equivalent carbon savings of removing 340,000 cars from America's roadways.

KEY WORDS

Linear Optimization, Mixed Integer Optimization, Transportation Optimization, Wireless Networking, MIP

TOPIC AND SUBTOPIC

Topic: Software and Services
Subtopic: A.2 Knowledge discovery, search, data mining, data management and/or visualization

PROJECT DESCRIPTION

EXECUTIVE SUMMARY

Billions of dollars are spent annually shipping vehicles. Banks, car rental agencies, manufacturers, consumers, dealers, credit unions all move billions of dollars of this cargo without a centralized reservation system comparable to what Sabre Travel Network provides for the airline industry.

Auto transporters regularly travel with spare capacity to car auctions make return trips with empty haulers. They have no means of advertising their supply and customers with vehicles to ship have no means of finding them. The net result of this inefficiency is higher shipping costs and lost business opportunities.

No solution exists because (1) optimizing vehicle shipping is a complex problem requiring access to extensive, fragmented data, and (2) intelligent, consumer-grade, wireless devices are only now emerging.

A team of qualified entrepreneurs and technologists are being assembled to create ManyWheels, a reservation and scheduling system for optimizing automobile shipping. ManyWheels will initially target large brokers and transporters in the wholesale automotive market.

A foundation for success is being built on:

- A business challenge identified by Manheim, the multi-billion dollar leader in the wholesale automotive business. As noted in the letter of support, Manheim has agreed to provide an executive industry adviser with 10 years of experience in the business.
- An addressable market of hundreds of millions of dollars that leverages long-term trends such as rising fuel costs, carbon emission reduction, and ubiquitous intelligent wireless devices.
- A start-up CEO with experience in all phases of new company and product development for similar technologies and relationships based on working experience in strategic venture capital.
- Researchers in NSF Industry/University Cooperative Research Center at the Nebraska Site for Centers for Engineering and Logistics Distribution to solve the complex optimization challenges.

In this Phase 1 Research effort we will

- Continue to analyze the complex, fragmented data challenges with prospective large customers
- Determine if practical solutions exist to the real-time network optimization problems
- Develop an Alpha product roadmap with prospective customers and a capitalization plan

IDENTIFICATION AND SIGNIFICANCE OF THE INNOVATION

THE US AUTOMOBILE MARKET

In 2007 approximately 80 million vehicles were sold in the United States.

- 16 million new vehicle sales, primarily consumers purchasing from dealers.
- 41 million used retail sales of consumers buying and selling from dealers and other consumers.
- 23 million wholesale vehicle sales between banks, dealers, rental car agencies, and others.

By any measure, the market is massive; used vehicle sales alone generate $350B, the largest domestic retail market. These transactions create other large markets such as vehicle financing, reconditioning,

and transportation [2, 5, 6]. The ManyWheels project addresses the challenges in efficiently transporting these 80 million vehicles, focusing first on the activities within the wholesale automotive market.

WHOLESALE AUTOMOTIVE MARKET BACKGROUND

In spite of the size and reach of $195B wholesale vehicle market, few consumers understand how it works or even know that it exists.

When consumers purchase a new vehicle they frequently trade-in their old vehicle; the dealer will often sell the vehicle in the wholesale market instead of selling it himself. For example, suppose you trade-in your Honda Civic to a Ford Dealer when purchasing a new Mustang. The Ford dealer doesn't specialize in Hondas and chooses to sell the Civic at an auto auction to a dealer who sells Hondas.

Rental car agencies, banks, auto manufacturers, and others also sell cars to dealers through wholesale auto auctions. Companies such as Manheim and ADESA host wholesale auto auctions at hundreds of locations. Underlying this seemingly simple process is a rich, complex, and dynamic market.

Regardless of the type of transaction, one event occurs with every sale: the car is transported from seller to buyer.

EXAMPLE: JOURNEY OF A USED HONDA CIVIC

Let's return to the Honda Civic example and follow the Civic's journey from a consumer in Reading, Pennsylvania to a consumer in Chantilly, Virginia.

In a fit of mid-life crises, Johnny Hotrod chooses to upgrade his 2001 Honda Civic for a 2008 Ford Mustang Convertible. Johnny trades-in his old car as part of the purchase.

The Ford Dealership doesn't sell Hondas and decides to get the best price possible for the Civic in the wholesale market along with a Cadillac and a Jeep he acquired in other transactions. Johnny calls A-1 Auto Transporters and schedules a shipment of the three vehicles to Manheim, PA to be sold at a Manheim wholesale auction. A-1, a small business owned by Hank Hauler, has an auto transporter with a 9-car capacity. Hank picks up the 3 vehicles from the Ford dealership and hauls them to Manheim, PA.

Unbeknownst to Hank, he drives past a Hertz Rental Agency with cars that need to be shipped to Manheim for the same auction. Since Hank has 6 extra car slots on his transporter, he could carry the additional cars. Hank misses the business opportunity and Hertz calls a different transporter, ultimately paying more than Hank would have charged for carrying additional cars to the same location.

In addition to the economic inefficiencies – exacerbated by increasing fuel costs – the spare capacity on Hank's car hauler results in additional carbon emissions as other car transporters duplicate the route.

Hank delivers our Civic to the Manheim auction in Manheim, PA. There it is sold to a Honda Dealership in Chantilly Virginia. The Honda Dealer needs to move the car from Manheim to Chantilly and decides to use Tom's Transport Services, an auto shipping broker.

Tom runs a more sophisticated auto shipping service. The Honda dealer can place his order online and Tom has staff with logistics training that handles the order. Tom has some simple software that helps his team manage the orders, access a database of transporters, process payments, and perform other basic workflow functions. Since Tom has a trained staff, his company can often coordinate orders to ensure that a particular auto transporter carries more cars than just the Civic. In this instance they combine the Civic shipping order for another order in Virginia and hire Bob's Big Car Hauler to move the vehicles.

Tom is proud of his staff for combining the orders, but recognizes that a lot of inefficiencies exist in this process. If only he knew the location, capacity, and licensing restrictions of all available transporters in Manheim, PA he could auction the business to the lowest bidder. With such a process he could scale his business better, achieve higher profit margins, and win more business by offering better prices.

Bob has an 8-car capacity hauler and wants to fill it for the shipment. By combining the business from Tom's Transport Service with other orders he received he departs for Virginia with 5 vehicles on his transporter. While on the trip, Bob drives through Baltimore Maryland and passes the home of Susie Slowpoke who recently sold a VW Beetle on Ebay Motors to a buyer in Chantilly, VA. Tom misses the opportunity to get some additional business with his 3-car transporter capacity and Susie calls another transporter to move the Beetle to the new owner in Chantilly.

Bob completes the drive to Chantilly, delivers the Civic to the Honda Dealer, and prepares for his return trip home. He wants to transport vehicles on his return and make some money. He makes a few phone calls but can't locate additional cars and makes the drive back to PA with an empty transporter.

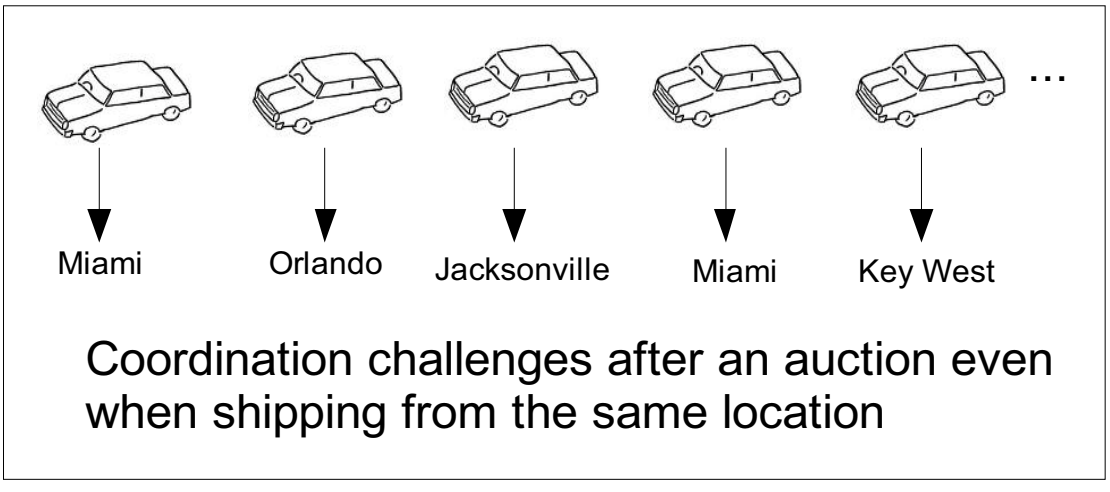
AUTOMOBILE TRANSPORTATION PROBLEM

The Honda Civic example illustrates key inefficiencies in the automobile transportation industry. The industry lacks a comparable system to Sabre Travel Network reservation system developed by American Airlines during the last half of the 20th century. In the case of the airline industry and automobile transportation there is a need for the following:

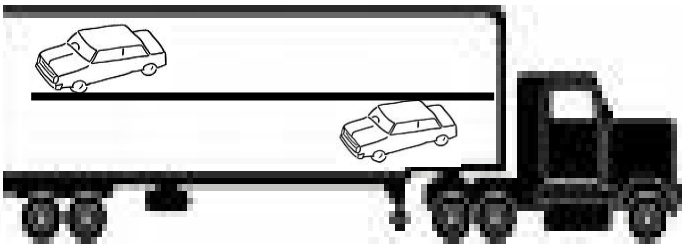
- Basic market mechanisms between transporters (airlines or auto transporters) and those needing to move cargo (people or cars) such as pricing discovery and transparency, supply representation, search and matching, authentication, and settlement. [11]
- An open system that allows connection by hundreds of thousands of disparate actors in the process using widely-available interfaces.

In the case of the automobile transportation industry, the net result is the following:

- Consumers, car dealers, rental car agencies, banks, transport brokers, and others have no open reservation system for scheduling auto transportation.
- Even within a wholesale auction or brokerage service there is limited coordination between desk clerks to combine orders. As a result, they ship cars from the same origin to the same destination for different customers using different transporters [9].



- Auto transporters operate their businesses inefficiently without the means to advertise real-time the available supply to prospective customers.



Auto transporters are unable to advertise real-time supply and often transport vehicles with unused capacity.

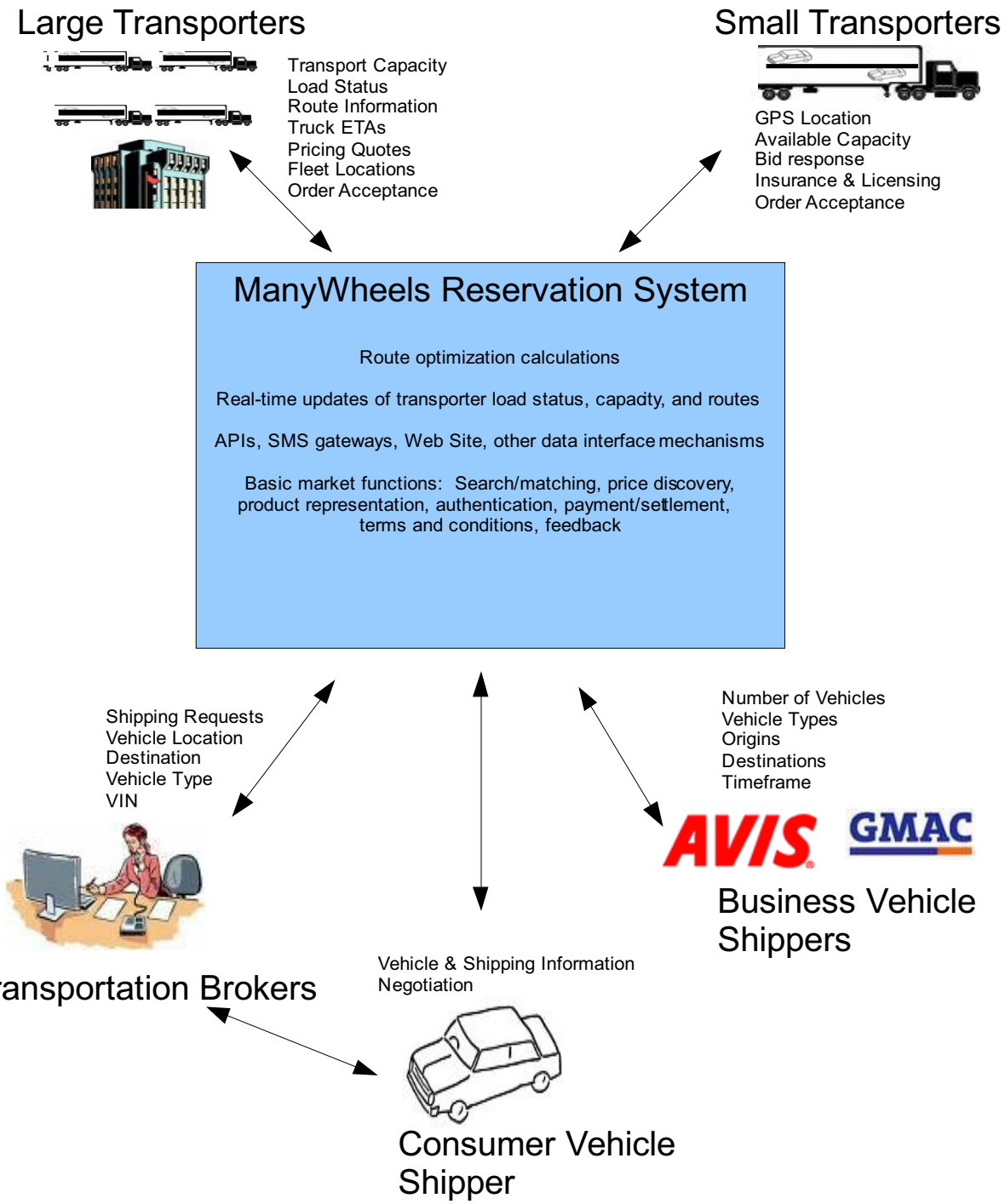
THE MANYWHEELS SOLUTION

ManyWheels will solve the automobile transportation challenges by creating a reservation system that provides basic market mechanisms to automobile shippers (demand) and transporters (supply).

The complexities in route optimization calculation and the interface challenges of the market prevent the use of a completely open system that asks shippers and transporters to work-out the best match. The highly fractured market consists of thousands of businesses shipping millions of pieces of cargo among 10,000 transporters [1] which often have limited existing communications infrastructure.

ManyWheels will accept data from multiple sources and do the complex calculations necessary to help match shippers with transporters that have the capacity, availability, appropriate licensing and insurance requirements, and price that best fits the shippers' needs. The service will also provide the standard market-making mechanisms such as authorization, authentication, dispute resolution, feedback, payment processing, and fulfillment.

While we focus primarily on the initial Alpha customers in this proposal – large transportation services, brokers, and transporters within the domestic wholesale market – ManyWheels will ultimately be extensible to anyone who needs to ship a vehicle or other large piece of cargo worldwide.



BACKGROUND AND PHASE 1 TECHNICAL OBJECTIVES

In Phase 1 we will focus on determining whether the technology challenges can be overcome to develop an Alpha service for the initial target market, large players in the wholesale automotive market.

Key questions need to be answered in Phase 1 to determine the commercial viability:

1. Does a sufficient data infrastructure exist to allow the development of a real-time reservation system for transporting automobiles? If not, can one be developed quickly through business partnerships or cost-effectively deploying new solutions?

2. Using the available data, can theoretical optimization models be developed that will improve the efficiency of automobile transportation over existing practices? What are the minimal data sets necessary to get this improvement? How much efficiency can be gained?

3. Can the optimization models be executed fast enough using commercial-grade computing hardware to allow the development of a real-time automobile transportation reservation system?

4. Given the data and optimization rules, what business logic would govern the marketplace? How would business processes work and how would transporters and shippers interface with the system?

5. Given the market fragmentation, computational complexity, and data challenges, is there a capitalization plan that will allow ManyWheels to be developed by a start-up company?

PHASE 1 RESEARCH PLAN

PART 1 – DATA GATHERING AND TECHNICAL ANALYSIS

ManyWheels will succeed or fail largely on its ability to cost-effectively access and process the data about the transportation capacity in the market. We will identify the sources of data, owners, APIs, systems interfaces, and data availability shortcomings that will challenge the practical business issues of building the ManyWheels reservation system. For example, a necessary piece of data may be real-time GPS coordinates and transporter capacity. Such data may require transporters to procure new technology (e.g. GPS-enabled cell phones or programmable navigators such as Dash, http://www.dash.net). Alternatively, data necessary to build a rich transportation network may be "locked up" in existing legacy systems that are economically challenging for access by a start-up company.

We will be working with the following:

Transporters – we will be interviewing large transporters to understand the challenges faced in transporting vehicles, how they currently identify new customer opportunities, existing route optimization methods, and processes for improving capacity. We will examine existing database structures, software APIs, and interfaces to understand how data is currently captured and routed among transporters.

Transport Services and Brokers – we will work with the services that capture customer shipping orders to understand the workflow processes, data is currently available from shippers, data sources, existing algorithms, and what is transmitted to and from transporters. As noted in our letter of support, we have already engaged Manheim Transport Services on this topic.

PART 2 – NETWORK OPTIMIZATION GAPS ANALYSIS

We will develop the theoretical mixed integer optimization models to identify routes that minimize travel and maximize the number of used cars that can be transported.

Software such as ILOG CPLEX, ILOG JViews, and ILOG JRules will be used for development of models that support planning and scheduling optimization for ManyWheels reservation system. There are a myriad of mixed integer optimization models used in software programs (also referred to as the mixed integer program (MIP) solvers) that have been studied in the transportation industry and have been successfully integrated into commercial software (notably eBay, Zurich, MetLife proprietary systems and

Sabre). Researchers at the University of Nebraska-Lincoln will identify the most relevant models, evaluate the cost effectiveness, and identify input variables necessary.

We will complete the following steps:

- Background Search of Similar MIPs
- Construction of Software typical Transportation Problem
- Identification of best MIP solution for ManyWheels
- Identification of data capture interface and front end for needed parameters

We will also be developing a data gaps analysis based on other data that would need to be generated to develop route and transport capacity optimization.

We will evaluate the computing hardware necessary to produce a reasonable solution at a reasonable time on a typical customer computing system. Optimization models can take a large amount of time, a large amount of computing power, and only produce a minimal gains in optimized solutions. We will determine if algorithmic shortcuts or pre-processing rules can reduce the computational complexity.

PART 3 - ALPHA PRODUCT ROADMAP DEVELOPMENT

In Part 3 we will be developing the Alpha product roadmap based on the system data needs and optimization rules identified in Parts 1 and 2.

The PI has extensive experience building new software products and recognizes the need for close collaboration and iterative development with prospective customers. This dialog is key to understanding the practical challenges such as data analysis and integration work necessary to build a new service.

Many of the market participants (e.g. transporters) will lack the technical sophistication or resources to use anything beyond consumer-level technology (web sites, navigators, cell phones, PDAs, etc.). We will focus on the limitations of the market participants to guide our interface development efforts. We will develop use cases, software architecture diagrams, data flow models, feature sets, sample screen shots, and other information necessary to build an alpha version of ManyWheels.

PART 4 – CAPITALIZATION PLAN

Based on the algorithmic complexities, data integration challenges ,and anticipated development costs we will develop a capitalization plan for building an Alpha version of the product.

COMMERCIAL POTENTIAL

MARKET OPPORTUNITY

By every measure an enormous amount of money is spent each year shipping automobiles. In spite of the size, the fragmented nature of this activity has limited the availability of detailed, segmented data about the market. We estimated the market size based on publicly available information and vetted assumptions with industry leaders. [9]

It is worth noting that the market for the ManyWheels will be riding the wave of several major, long-term business trends:

- Rising energy prices Transportation inefficiencies waste fuel and increasing energy prices improves the financial models for ManyWheels.

- Carbon footprint reduction Inefficient use of automobile transporters causes more carbon release. ManyWheels is a "green" investment opportunity.
- Wireless Intelligent Networks Products such as Dash (http://www.dash.net) and Kleiner-Perkins $100M iPhone application fund will be sources of partnerships.

THE WHOLESALE AUTOMOBILE MARKET OPPORTUNITY FOR MANYWHEELS

As a start-up company, ManyWheels will need to focus on specific markets and services. As discussed in our Revenue and Financing sections, we plan to initially target large transportation brokers and transporters in the wholesale automotive market because these customers represent a more attractive sales target, have existing systems to handle many workflow and payment processing activities, have articulated demand for the service, and they represent a potential source of funding.

If successful, the ManyWheels Reservation Service will reduce the total cost of transporting automobiles and the carbon emissions generated. These savings will be captured by ManyWheels as well as automobile buyers, sellers, brokers, and transporters. We thus can estimate the potential addressable market for ManyWheels as the percentage of the cost savings the company can generate in transporting vehicles less that captured by other market participants.

Transportation cost savings in the wholesale market

The following is confidential information that ManyWheels requests not be released to persons outside the Government, except for purposes of review and evaluation.

- An average vehicle is shipped 125 miles at a cost of $175 per vehicle; additional vehicle loads to fill capacity can lower these costs to $115 per vehicle, a 34% savings. Vehicles sold online are usually shipped further at higher cost but we will $175 as conservative estimates. [9]
- 23 million wholesale market vehicle sales generate at least 30 million transportation events. [9]
- $175/vehicle transport * 30 million transportation events = $5 billion spent annually shipping automobiles in the wholesale market.

ManyWheels Market = Total Cost of Transporting Vehicles x Efficiency Generated by ManyWheels – Percentage of Savings Captured by Other Market Participants.

Automobile transportation efficiency generated by ManyWheels	Total transportation costs savings in the wholesale vehicle market ($M)	Percentage of savings captured by other market participants	Addressable market for ManyWeels ($M)
8%	375	75%	94
15%	750	60%	300
20%	1000	40%	600

Thus under assumptions based on available data from public sources and industry experts there is at least a $100 million market opportunity for ManyWheels in the wholesale automobile market alone.

Are these reasonable estimates?

Consider the challenges faced by the market participants in the *Journey of the Used Honda Civic* example described earlier. In the absence of real-time, demand information from prospective customers the auto transporters inefficiently haul loads with spare capacity. For instance, Bob departs the auction with 5 of 8 vehicle slots filled on his transporter and returns with zero cars. By definition his round-trip was less than 50% efficient at transporting vehicles. It is reasonable to expect Bob to pay $15 for each vehicle he can locate and load on his truck since the alternative is no revenue.

Assuming the 30 million transporters each has a capacity of 8 vehicles, the total transportation capacity is 240 million vehicles. At $15 per transaction, ManyWheels would need to fulfill 7 million slots – merely 3% of the transportation capacity - to reach $100M in revenue.

Carbon emissions savings

Although ManyWheels will reduce the emissions from transporting automobiles, "carbon credits" are unlikely to generate revenue in a fractured market. However, the positive environmental impact will attract customers to the system based on civic duty and good PR.

Since an automobile transporter releases 4.8 lbs of CO2 per mile [7], the 46 million transportation events generate roughly 12 million metric tons of CO2 annually. Reducing carbon emissions by 10% will create the equivalent savings of removing 340,000 cars from America's roadways [12].

OTHER MARKETS BEYOND WHOLESALE AUTOMOBILES

New Automobile Market – The 16 million new vehicles sold in the US must be transported from point of origin (port, manufacturer, etc.) to a dealer. Based on discussions with industry experts, **every one of these auto transporters returns to the point of origin with an empty transporter** [9]. These vehicles are often shipped over much longer distances and at a cost of $1000 or more. ManyWheels has the opportunity to both provide transportation efficiency to the movement of new vehicles and provide transporters with a means of generating additional revenue on the return trips.

Consumer Markets – Beyond the wholesale automotive market, another large market exists in consumer-consumer used vehicle sales and consumer automobile shipping (e.g. retired "snowbirds" who ship cars annually to and from Florida, consumers moving). Data for the consumer-consumer used automobile market is particularly sparse and the consumer market has additional challenges such as picking-up vehicles at a consumer's home, tracking progress, etc. [9] The spare capacity in these automobile transporters and potential partnership opportunities with transaction sites such as eBay Motors represent opportunities for ManyWheels.

International Markets – The world will have over 1 billion vehicles by 2010 [13] and international markets may be the largest growth segment in the next decade. The industry is faced with challenges such as dealing with NAFTA rules and decisions over rail vs. transporter shipping as it expands internationally. This growth also presents opportunity for ManyWheels [9].

Other goods shipments – Discussions with industry researchers have suggested that similar challenges and opportunities exist in shipping agricultural and construction equipment. The technology foundation for ManyWheels may be extensible to these markets as well.

RISKS AND MITIGATIONS

The size of the market opportunity for ManyWheels begs an obvious question:

"Why doesn't a solution exist?"

Underlying this seemingly simple process of loading more vehicles onto transporters and selecting optimal routes is a highly complex set of technology challenges not unlike those faced by Sabre in developing an airline reservation system. Solving them is not an incremental business opportunity for ISVs, transporters, brokers, or other the participants in this fragmented market [9].

TRANSPORTER DATA AND TECHNOLOGY CHALLENGES

There are 10,000 automobile transporter trucks in the US [1]. The trucks have different capacities and can hold different types of vehicles at different capacities (e.g. a truck can hold 6 Compacts or 4 SUVs) . Moreover, the process of loading the trucks with vehicles changes the optimal route as transporters prefer a "LIFO" process to unload vehicles.

Transporters have different insurance and licensing requirements in different states to haul different types of vehicles. Many transporters also often run unsophisticated operations and do not have the interest or capacity to optimize route selection and loading process.

The following is confidential information that ManyWheels requests not be released to persons outside the Government, except for purposes of review and evaluation.

In initial industry discussions, ManyWheels has learned that optimizing transportation capacity and routing requires real-time access to the following information about the transporters:

- What vehicles are already loaded on the truck?
- What is the order of loading?
- What is the existing route path?
- What is the ETA at the next destination?
- What is the planned order of unloading?
- What type of truck is the transporter operating?
- Who is operating the truck?
- What is his or her existing assignments?
- What are his or her insurance and licensing restrictions to haul different types of vehicles?

Accessing detailed data from the transporters and pulling it into a centralized location is the key challenge for ManyWheels [9]. Although large market players have much of this data in centralized databases, accessing it from legacy systems may prove financially challenging for a start-up.

Potential mitigations include:

- Working with prospective customers, ISVs, and large market participants to establish working groups for developing industry data standards.
- Partnering initially with larger auto transporters which operate 1 type of truck.
- Working with transporters that have Internet access inside the trucks and enough sophistication to include some human decision-making in the optimization process.
- Phasing the rollout of ManyWheels by first utilizing the most-accessible, most useful data available from large, well-established customers.
- ManyWheels may have to partner with (or develop) wireless devices that can be carried by transporters to facilitate the marketplace. Initially the adoption of these devices would be limited to larger transporters. Fortunately programmable, GPS-enabled devices with connections to wireless networks like GPRS are emerging.

COMPUTATIONAL OPTIMIZATION CHALLENGES

Even if all of the data is available, calculating the optimal routes real-time may cause scaling challenges. For example, imagine that a shipping customer asks for a quote to move a vehicle from Atlanta to Washington, DC. Algorithms would have to compute the available options based on the extensive transporter data described earlier. Recalculating these options real-time with each request will not scale.

Addressing this challenge is a key goal in Phase 1 and options for pre-processing data and improving optimization will be addressed by Logistics Researchers in NSF Industry/University Cooperative Research Center at the Nebraska Site for Centers for Engineering and Logistics Distribution.

While very large in aggregate, the market for automobile shipping is highly fragmented among the thousands of auto transporters, brokers, and shippers. A fragmented market can create marketing and per-sales costs that exceed the marginal financial contribution from each sale.

We will initially focus on solutions for the largest industry players such the wholesale market makers (e.g. Manheim, ADESA), large automobile transporters (e.g. Hansen's), and large dealers (e.g. CarMax).

COMPANY/TEAM

ManyWheels is a start-up company being created around the opportunity to address the market need for automobile transport solutions. The idea for creating ManyWheels originated when Manheim began discussing the needs for a commercial solution to vehicle transportation with the National Science Foundation. A team of qualified, experienced entrepreneurs and technologists are now being assembled to create the company. A foundation for success is being built on:

- The pursuit of a solution to a business challenge identified by Manheim, a well-run, multi-billion dollar company. As noted in the letter of support, Manheim has agreed to provide an executive industry adviser with 10 years of experience in the automobile remarketing business and a personal network with major automobile industry players
- An addressable market of hundreds of millions of dollars that leverages long-term trends such as rising fuel costs and carbon emission reduction.
- A start-up CEO with experience in all phases of new company and product development for marketplace services and relationships based on working experience in strategic venture capital.
- Logistics Researchers in NSF Industry/University Cooperative Research Center at the Nebraska Site for Centers for Engineering and Logistics Distribution

[redacted]

[redacted]s over 15 years experience driving technology innovation in start-ups, large companies and the federal government. He has held leadership roles in all aspects of entrepreneurship including fundraising, product development, software engineering, business development/sales, and strategic marketing/brand development.

He has a unique combination of technical and business experience and skills relevant to this project:

Technology and business experience in large markets
[redacted]systems and software teams that regulate the NASDAQ Stock Market. In this capacity he became familiar with the technical and operational complexities of running a market and integrating market data. He was also member of the company's "new ventures" team and developed the business plans to commercialize the company's regulatory applications.

Entrepreneurial experience raising funding and building a new marketplace service
[redacted] marketplace from the ground-up after securing $2M in funding and ran all aspects including development and operations.

Strategic venture experience
At In-Q-Tel, the investing arm of the Central Intelligence Agency[redacted]ed make over $20M of venture investments into 25 technology start-ups. He also helped the CEOs and management teams in these start-ups deploy their products to their markets. This experience has helped him develop personal relationships with prospective investors and understand investor perspectives.

[redacted]

[redacted] is an assistant professor at the University of Nebraska-Lincoln.

[redacted] is the Nebraska site director for the Centers for Engineering Logistics and Distribution (CELDI) in the National Science Foundation Industry/University Cooperative Research Center (NSF I/UCRC) program. This program focuses on Universities providing application research that can support business success. He also is the Director of the RFID Supply Chain Lab (RfSCL) in Nebraska.

[redacted] instructs and performs specialized research in the areas of Logistics , Six Sigma Tools in Total Quality Management, and RFID Technologies.

Prior to joining Academia, [redacted] worked for United Parcel Service (UPS), Academy Sports and Outdoors, Tompkins Associates, and Arthur Anderson, LLP. He worked as an Industrial Engineering (IE) Specialist, Engineering Manager, and Director. In his positions as an engineering and business consultant, his consulting has ranged from ERP system implementations to Supply Chain Logistics Planning, and Organizational Strategy.

Dr. Jones is fellow of the Alfred P. Sloan Foundation and current administrator to the Minority Ph.D. Program at the University of Nebraska, and as current advisor to the National Society of Black Engineers he demonstrates his commitment to diversity.

PRODUCT/TECH COMPETITION

We have confirmed with large prospective customers that no solution exists to provide an open market and reservation system for transporting cars for the simple reason that the real-time supply data isn't available [9] and inexpensive GPS-enabled wireless data devices are only now emerging.. Much of the automobile transportation market still operates in pre-Internet time: people needing to ship cars contact a couple of transporter companies to get quotes and select the best option based on available information. Some of this exchange is done online or through reservation systems.

The larger transporters and brokers have developed or purchased systems that optimize shipping within their transportation network and business partnerships. Companies such as CargoTel, Inc. have transportation management software systems that allow for order entry, dispatch, routing, settlements, and asset tracking – basic workflow tools for in-house management of orders and shipping. These systems are often quite sophisticated and can use text messaging to communicate with GPS-enabled cellular phones within the transporter trucks. While there are potential areas of overlap between ManyWheels and these existing solutions, ManyWheels will not be seeking to replace them.

The challenge for ManyWheels is to develop a reservation system that interfaces with existing ISV and proprietary systems and enhances their value by providing access to real-time information about the status of supply and demand in the marketplace.

FINANCE AND REVENUE MODEL

ManyWheels will earn revenue from a similar model used by Sabre Travel Network. Auto shipping brokers and transportation services (analogous to airline travel agents) will pay a subscription fee for the service to get access to the network. Additionally, transporters (analogous to airlines) will be charged a transaction fee for new business.

The revenue and pricing mix will need to be explored with prospective customers to determine the most profitable model. In the mature, highly competitive airline industry the majority of Sabre's multi-billion dollar revenue comes from the $10-$15 booking fee from each flight. [6] Travel agents pay a subscription service for Sabre that begin as low as $45/month for an individual agent.

As ManyWheels grows, we expect the revenue mix to approach the model of the airline industry with the majority of the revenue coming from transporter fees.

However, we anticipate initial revenue to come from large shipping brokers and transporters who will pay a premium for access to the service for several reasons:

1. These companies currently have the most frustration with the inability to access real-time market and supply information [9]. With access to this information they can attract more shipping customers, attain higher margins, and provide better service.
2. Selling a service to a few large, well-financed companies is more feasible for a start-up.
3. Large transporters and brokers have existing in-house payment processing services and other market support systems. As a start-up ManyWheels will want to avoid the capital investment of building out these services and instead focus on its core competency of transport capacity and route optimization.
4. Large customers represent a funding source for ManyWheels as described in the financial model.

The following is confidential information that ManyWheels requests not be released to persons outside the Government, except for purposes of review and evaluation.

Vehicle shipping brokers charge 20-30% of the total shipping cost for their services, roughly $200 for consumer automobile shipments and (we estimate) $25-$35 for business automobile shipments. [8] These margins are sufficient to justify a subscription service to attract more business.

A business shipping broker that earns $500K per month in revenue handles roughly 15,000 transactions per month, less than 0.5% of the market for wholesale shipments. In conversations with large prospective customers, smart routing using excess transport capacity can reduce the cost of transporting each vehicle by $60 or more, a 30% savings. If the broker can use ManyWheels to place 5% of its orders on excess capacity it can generate an additional $45K per month in profit. No doubt some of this savings will be passed on to customers to generate more business.

These estimates suggest that ManyWheels could create a subscription service that charges $5K-$15K per month and achieve $1M in revenue with a few early Alpha customers.

Market-maker business models are attractive to investors because the profitability tends to scale faster than the cost of sales. Additionally, the "network effects" – more buyers attract more sellers which attracts more buyers – provide a competitive barrier to entry that allows the market leaders to have pricing power over customers.

The CEO of ManyWheels has experience raising money from institutional investors and has worked in venture capital. If the Phase 1 Research effort shows a promising path for solving the technology

problems, the size of the market will attract investors. There have also been initial conversations with prospective Angel investors. ManyWheels anticipates the following seed capital financial plan:

Customer Funding
The interest in the ManyWheels services shown by prospective multi-billion dollar customers suggests that the customers may be able to fund part of the technology development. These agreements would likely exchange equity, board seats, professional services, integration work, and subscription discounts for the investment by these companies in developing the technology. ManyWheels will work with large companies to develop the business cases for making these investments.

Strategic Angels
ManyWheels will face two critical business challenges in building the service that can be addressed by bringing "smart money" Strategic Angel Investors aboard.

1. ManyWheels will need the credibility of industry executives from prospective customers in the automobile transport business. The ManyWheels CEO will be seeking Angels with experience in building innovative companies like CarMax aboard as investors.
2. Based on the outcome of this Phase 1 effort, ManyWheels will identify several tough technology challenges around distributed wireless information networking and optimization. ManyWheels will pursue Angel investors with niche technology expertise in solving these problems.

CONSULTANTS AND SUB-AWARDS/CONTRACTORS

Logistics Researchers in NSF Industry/University Cooperative Research Center at the Nebraska Site for Centers for Engineering and Logistics Distribution will have a sub-award in this proposal as noted earlier

EQUIVALENT OR OVERLAPPING PROPOSALS

None.

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June 6, 2008

[redacted]

Manheim Auctions, Inc. is pleased to endorse the Manywheels project. If Manywheels is successful in bringing significant new efficiencies to the vehicle transport arena, we will give serious consideration to becoming a customer of its service. A successful Manywheels service will enable us to provide a higher level of service to our customers, and potentially to improve the profitability of one of our business units.

I have discussed the Manywheels project with our president and CEO, Dean Eisner, who supports our involvement in the project. Dean has agreed to have me serve as an advisor to Manywheels. The executives who head our Manheim Transport business unit also support the Manywheels effort.

Manheim is a subsidiary of Cox Enterprises, and is the worldwide leader in the wholesale automotive remarketing business. We do business with every manufacturer, financer and retailer of vehicles in the United States. Like most wholesale markets, the wholesale automotive market operates "beneath the radar." Nevertheless, the number of transactions and the dollar value of vehicles exchanged are large. In 2007, approximately 23 million used vehicles were exchanged in this market in the United States. The value of these vehicles was approximately $195 billion.

Almost everyone in this country is affected by the wholesale used car market, often without realizing it. If you have purchased a used vehicle, the price you paid was directly affected by prices in the wholesale market. If you've sold a used vehicle, the price you received was directly related to prices in the wholesale market. And if you own a car, it is now, by definition, a used car, whose value is subject to the vicissitudes of the wholesale market.

Like all markets, the wholesale automotive market is comprised of buyers, sellers and market-makers. Sellers in the wholesale automotive market are manufacturers (General

Motors, Ford, Toyota, Honda, BMW, Mercedes, etc.), their captive financial subsidiaries (GMAC, Ford Motor Credit, Toyota Financial Services, Honda Financial Services, BMW Financial Services, etc.), banks that write loans and leases on vehicles (Bank of America, Wells Fargo, Chase, etc.), commercial fleet management companies, and dealers. Buyers are all dealers, who segment into four major groups—large national chains such as AutoNation, CarMax and Lithia, local franchised dealerships (dealerships that sell both new and used vehicles), local independent dealerships (dealerships that sell only used vehicles), and wholesalers, who act as arbitrageurs in the wholesale market. Market-makers are companies like Manheim, which operate brick-and-mortar and electronic exchanges in the United States and in many other countries around the world.

Manheim operates 90 brick-and-mortar auctions in North America, and approximately 40 more in 12 other nations on three other continents. We also run two Internet-based exchanges. In addition, we have substantial operations in reconditioning cars (doing mechanical and cosmetic repairs), financing cars, inspecting cars, transporting cars, and several other components of the value chain.

In 2008, approximately six million vehicles will be bought and sold in our North American auctions. Each of these vehicles must be transported to the auction by its seller, and must be transported from the auction by its buyer. Today, this transportation is fragmented, uncoordinated and inefficient. We and our customers all recognize the inefficiency, and would like to reduce or eliminate it. It is our hope that Manywheels will be able to offer services that improve this situation.

Thank you.