



Anthropogenic Green House Gas Reduction using GNSS

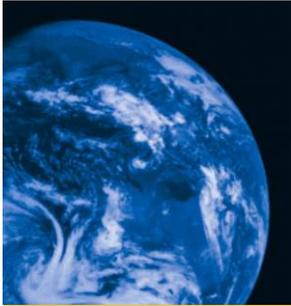
Fourth Meeting of the International
Committee on
Global Navigation Satellite Systems (ICG)

September 14-18, 2009

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Director, Strategic Partnerships
Trimble



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Agenda

- **Executive Summary**
- **What are the GHGs?**
- **How can AGHGs be reduced using GNSS? Two approaches:**
 - Increased fuel *use* efficiency
 - Process innovation
- **AGHG Reduction examples**
 - Heavy Truck idling
 - Heavy & Highway Construction
 - Mechanized Agriculture
 - Fleet management





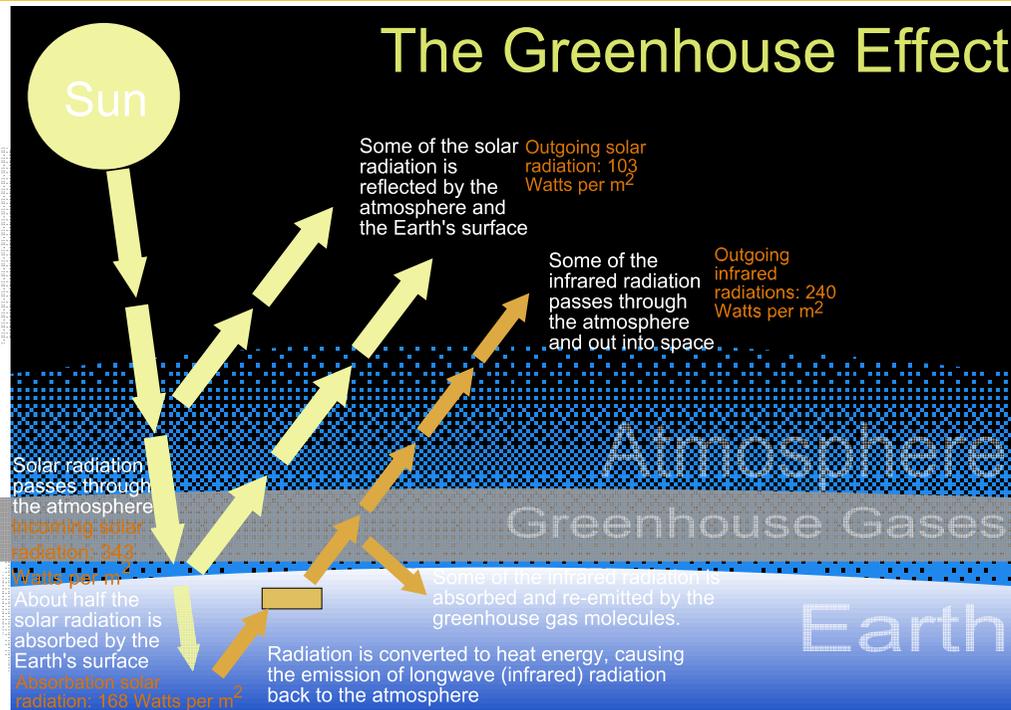
Trimble AGHG Reduction Executive Summary

1. **Strategy: Transform the World's Work through technology and innovation.**
2. **We use GNSS on complex workflow problems**
3. **AGHG reduction is one such problem**
4. **We have GNSS in > 200,000 customer "vehicles"**
5. **Our solutions have the ability to reduce CO₂ emissions by >100m tons annually**
6. **Equal to carbon footprint of ~5M people**
7. **The ROI on these GNSS solutions is typically less than 1 year**
8. **There are many adjacent areas available for AGHG reduction innovation with GNSS**





What are the Greenhouse Gases?



■ GHGs

- Water vapor
- Carbon dioxide (CO₂)
- Methane (CH₄)
- Nitrous oxide (N₂O)
- Ozone
- CFCs

■ Anthropogenic GHGs

- Carbon Dioxide (72%)
- Methane (18%)
- Nitrous Oxide (9%)

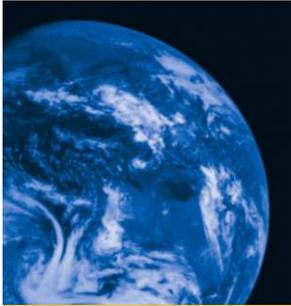




GHG Reduction Approaches with GNSS

- **Increased fuel *use* efficiency**
 - Idle time reduction
 - Route selection
- **Process innovation**
 - Guidance
 - Driver assist
 - Innovative methods
 - Other...





US Heavy Truck -Idling

- **458K US heavy trucks, traveling over 500 miles (800 km) per day**
 - **Generally idle overnight (~5 hours)**
 - **1 gallon (3.78 liters) per hour**
 - **In the US this is ~598 M gallons of fuel (2,260m Liters) used for idling annually**
 - **Heavy Truck fleet generates ~6.6m tons of CO₂ annually idling**
 - **25% reduction in fleet idle time = 1.6 m ton annual CO₂ reduction**



25% idle reduction is achievable using GNSS enabled systems

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Construction Activities

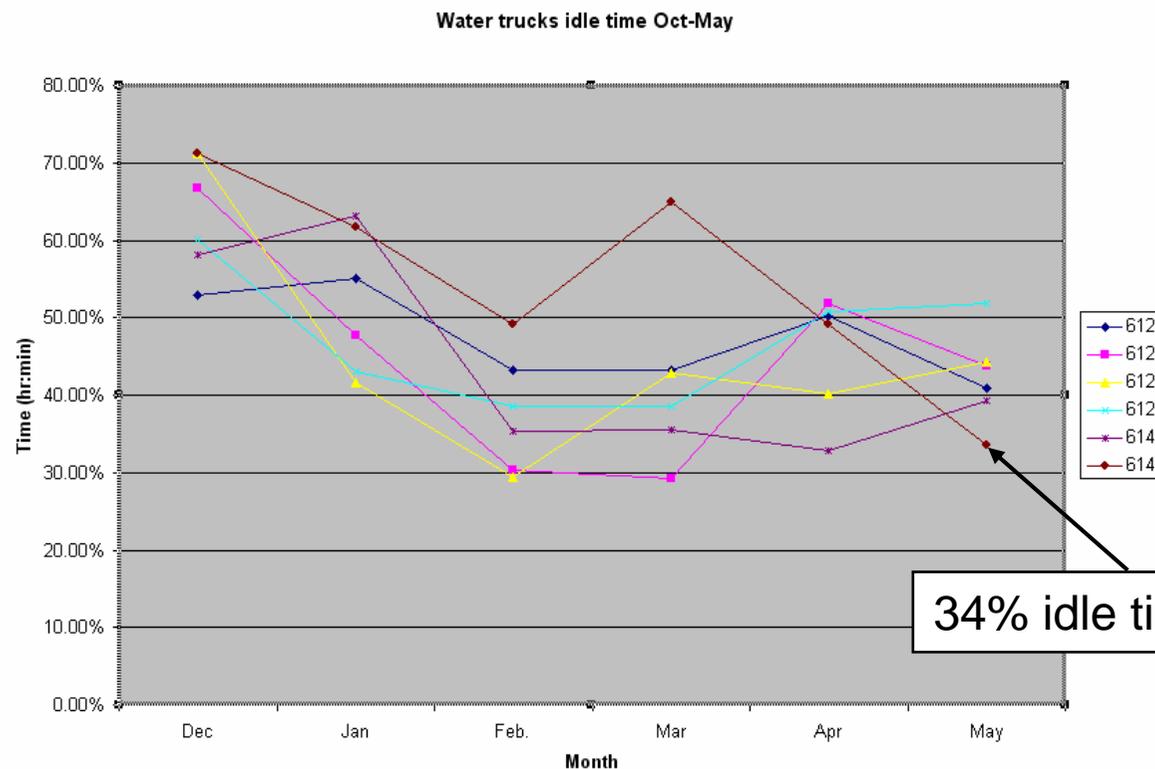
- **Machine control: up to 70% increased job site productivity**
 - **Reduced fuel consumption and therefore reduced AGHG**





Construction Activities

- Improved asset utilization increased job site efficiency
 - Reduction in idle time reduces AGHG emissions



34% idle time reduction





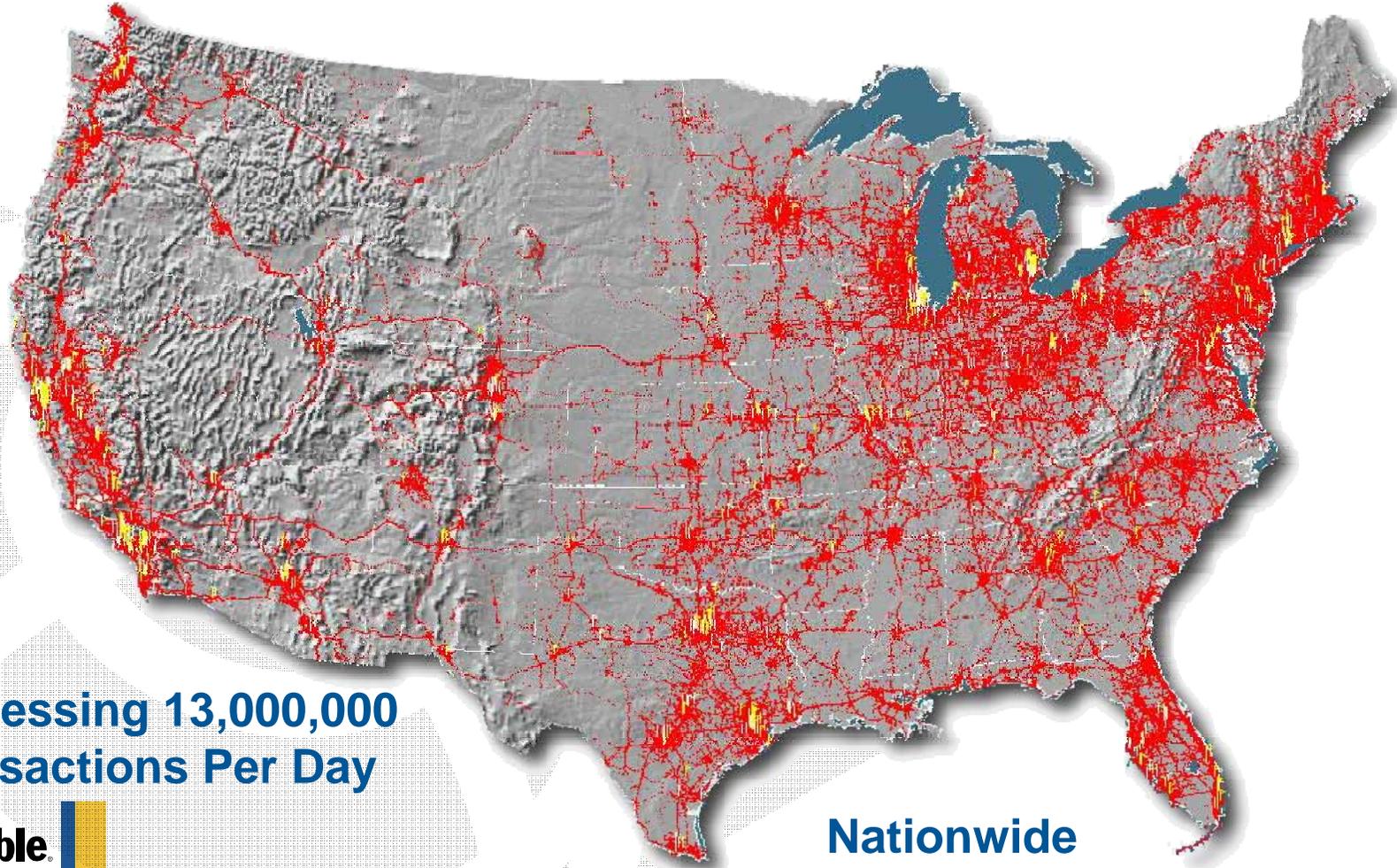
Agricultural Activities

- **Guidance**
 - The ability to consistently navigate an implement to within 1 cm allows process innovation
 - Enables strip tillage/no tillage
 - Reduces load on equipment and reduces fuel consumption
 - Reduces process time
- **Herbicide/nutrient application**
 - New technology allows for plant specific applications
 - Up to 80% increase in efficiency
 - This results in less CO₂ and N₂O





200,000 Trimble GNSS Users on the Road



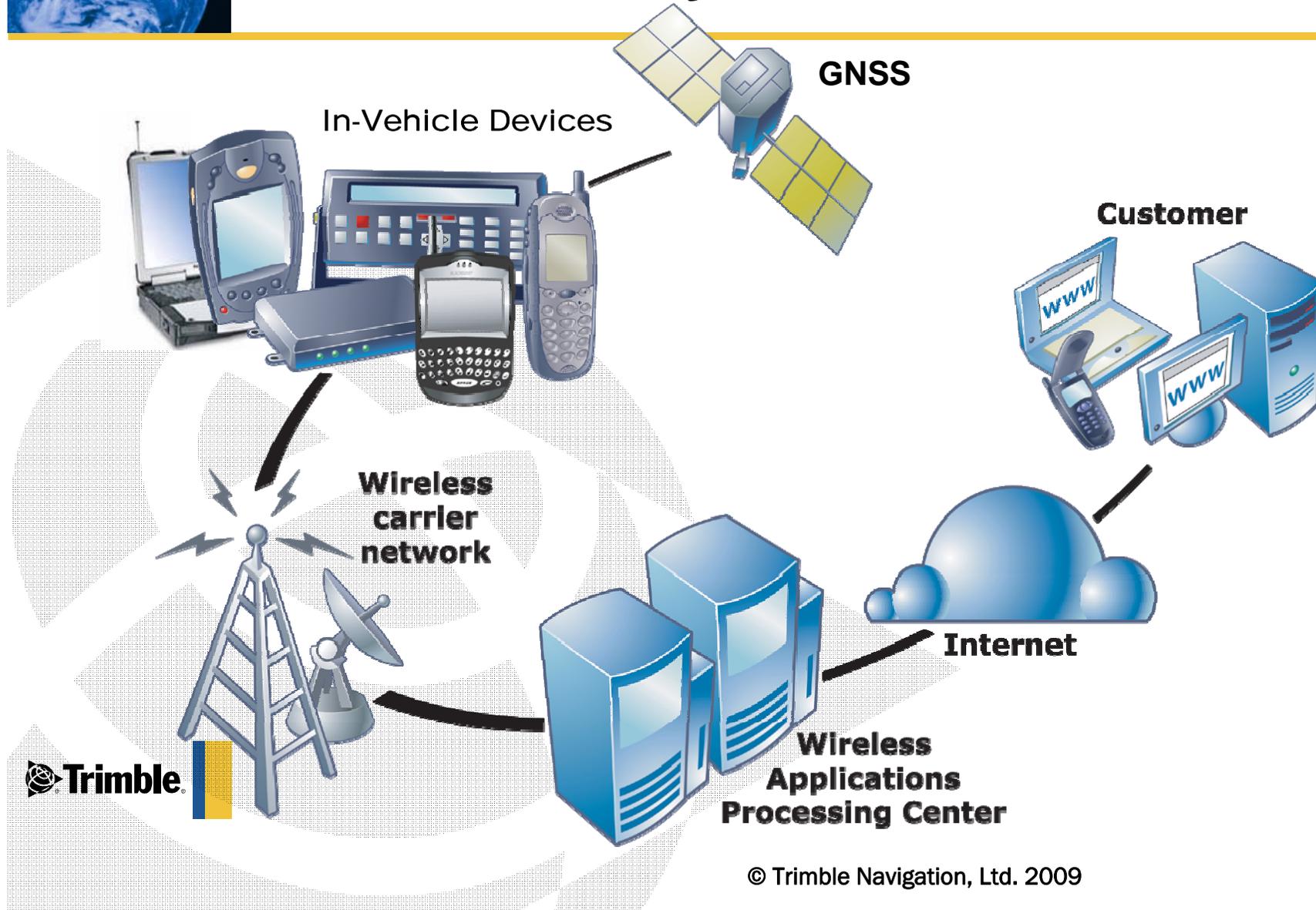
Processing 13,000,000
Transactions Per Day



Nationwide
Coverage



Trimble Fleet Management GNSS System Overview





OBDII-Based Trip Summary Report

(provides baseline & progress metrics)

Vehicle	Trip Count	Duration				Fuel							Trip Distance (M)	Average Speed (mph)	Maximum Speed (mph)	Max RPM (rpm)	Stop Count	Event Count
		Driving (DD:HH:MM)	Idle (DD:HH:MM)	PTO (DD:HH:MM)	Trip (DD:HH:MM)	Driving (gal)	Idle (gal)	PTO (gal)	Trip (gal)	Before Trip (gal)	Overall MPG	DrivingMPG						
02519-5056	28	0D:5H:19M	0D:2H:23M	0D:0H:0M	0D:7H:48M	10.69	2.13	0	12.82	N/A	15.31	18.37	196.28	37.13	76.43	N/A	21	0
02528-5066	25	0D:4H:43M	0D:1H:54M	0D:0H:0M	0D:6H:40M	10.17	1.48	0	11.65	N/A	36.78	42.14	428.5	91.81	78.91	N/A	24	0
02588-5060	28	0D:12H:26M	0D:1H:31M	0D:0H:0M	0D:10H:14M	6.64	30.17	0	36.81	N/A	9.81	54.37	360.96	11.55	72.7	N/A	19	0
02609-5062	55	0D:8H:29M	0D:5H:52M	0D:0H:0M	0D:14H:21M	15.99	3.88	0	19.87	N/A	14.56	18.1	289.37	34.31	71.46	N/A	47	0
02615-5064	53	0D:10H:22M	0D:3H:35M	0D:0H:0M	0D:13H:57M	20.77	3.58	0	24.35	N/A	15.76	18.48	383.88	37.38	78.91	N/A	55	0
02661-5052	50	0D:14H:41M	0D:7H:31M	0D:0H:0M	0D:22H:16M	28.76	5.89	0	34.65	N/A	16.4	19.76	568.3	38.88	75.19	N/A	66	0
02667-5051	57	0D:10H:6M	0D:7H:24M	0D:0H:0M	0D:17H:30M	21.08	5.89	0	26.96	N/A	12.24	15.66	330.01	32.78	75.81	N/A	59	0
02677-5065	48	0D:8H:37M	0D:6H:19M	0D:0H:0M	0D:14H:55M	13.34	4.78	0	18.12	N/A	13.23	17.97	239.79	28.21	67.11	N/A	53	0
47598-5055	44	0D:9H:30M	0D:9H:23M	0D:0H:0M	0D:19H:4M	20.74	6.4	0	27.13	N/A	14.75	19.31	400.35	42.67	78.29	N/A	33	0
47619-5058	17	0D:3H:57M	0D:0H:49M	0D:0H:0M	0D:4H:47M	10.14	0.8	0	10.93	N/A	17.05	18.39	186.41	47.78	75.81	N/A	15	15
50033-5053	43	0D:6H:33M	0D:7H:17M	0D:0H:0M	0D:13H:47M	0	0	0	0	N/A	0	0	211.45	32.27	52.82	N/A	47	0
52654-5059	45	0D:6H:7M	0D:8H:15M	0D:0H:0M	0D:14H:23M	12.74	5.85	0	18.59	N/A	13.23	19.31	245.93	32.75	73.32	N/A	49	0
64100-PC001	31	0D:8H:23M	0D:2H:6M	0D:0H:0M	0D:10H:24M	0	0	0	0	N/A	0	0	307.58	36.69	72.08	N/A	33	0
64461-OpsSup	45	0D:10H:44M	0D:6H:39M	0D:0H:0M	0D:17H:16M	20.03	4.71	0	24.74	N/A	16.69	20.62	413.08	38.49	75.81	N/A	46	0
Total	569	4D:23H:57M	2D:22H:58M	0D:0H:0M	7D:19H:22M	191.1	75.57	0	266.64	N/A	17.11	23.88	4561.9	36.56	78.91	N/A	567	15



Exceptions Notification Methodology

From: exceptions@ros
 To: rkosakura@ro
 Cc:
 Subject: Customer Landma

Sent: Sat 9/28/02 4:08 AM

**EMAIL and/or
 CELL PHONE SMS
 Message**

Exception Name : Ryan Landmark2
 Exception Type : Customer Landmark
 Vehicle : RyanK
 Exception Time : 09/27/02 05:26 AM

Exception Criteri
 Exception value

@ROAD MOBILE RESOURCE MANAGEMENT

Exception NOTIFICATION CONSOLE

Row	Date	Vehicle	Exception Type	Exc
4	09/30 08:25:47 AM PDT	RM-CDPD	Customer Landmark	AT L
5	09/30 08:23:14 AM PDT	RM-CDPD	Speed	AT s
6	09/30 08:23:13 AM PDT	RM-iDEN	Speed	RM s
7	09/30 07:48:24 AM PDT	RM-iDEN	Customer Landmark	RM L
8	09/30 05:44:19 AM PDT	RyanK	Speed	Ryan
9	09/29 11:59:59 PM PDT		Stop	Ryan
10	09/29 11:59:59 PM PDT		Stop	RM s
11	09/29 11:59:59 PM PDT		Stop	RM s
12	09/29 11:59:59 PM PDT		Stop	RM s
13	09/29 11:59:59 PM PDT		Stop	RM s

**NOTIFICATION
 CONSOLE
 Updated in Real-Time
 as you view it!**

Speed Exception Report from 8/22/02 12:00 AM to 8/27/02 12:00 AM

(Note: Date/Time is rounded off to the nearest minute)

Configuration Parameters

Exception Name	Jackson Spe
Exception Type	Speed
Maximum Speed	65 MPH
Duration	2 min(s)
Monitoring Scheduling Type	24 x 7
Monitoring Schedule	Begin date: 08/22/02
Vehicle(s) Monitored	JacksonP

**GENERATED REPORTS
 Automatic or Manual By
 Exception Type, Selected
 Employees, Date Range**

Vehicle : JacksonP

Summary

Number of Exceptions	23
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Detail:

Date	Time	Speed(Highest Attained)(MPH)	Duration (min)	Location(Address/Cross Street, City, State Zip)	County
08/22/02	06:48 AM (PDT)	75	2	1012 MCCARTHY BLVD/MILPITAS, CA 95035	SANTA CLARA
08/22/02	06:52 AM (PDT)	75	3	1 880 N/FREMONT, CA 94538	ALAMEDA

RM Zone 2 Arrival

Exception Details

Date: 09/29/02
 Name: RM Stop Count
 Value: 0 stop(s)
 Location: See Report
 Criteria: Minimum Stop(s): 3, Maximum Stop(s): 10, Duration: 5 min.

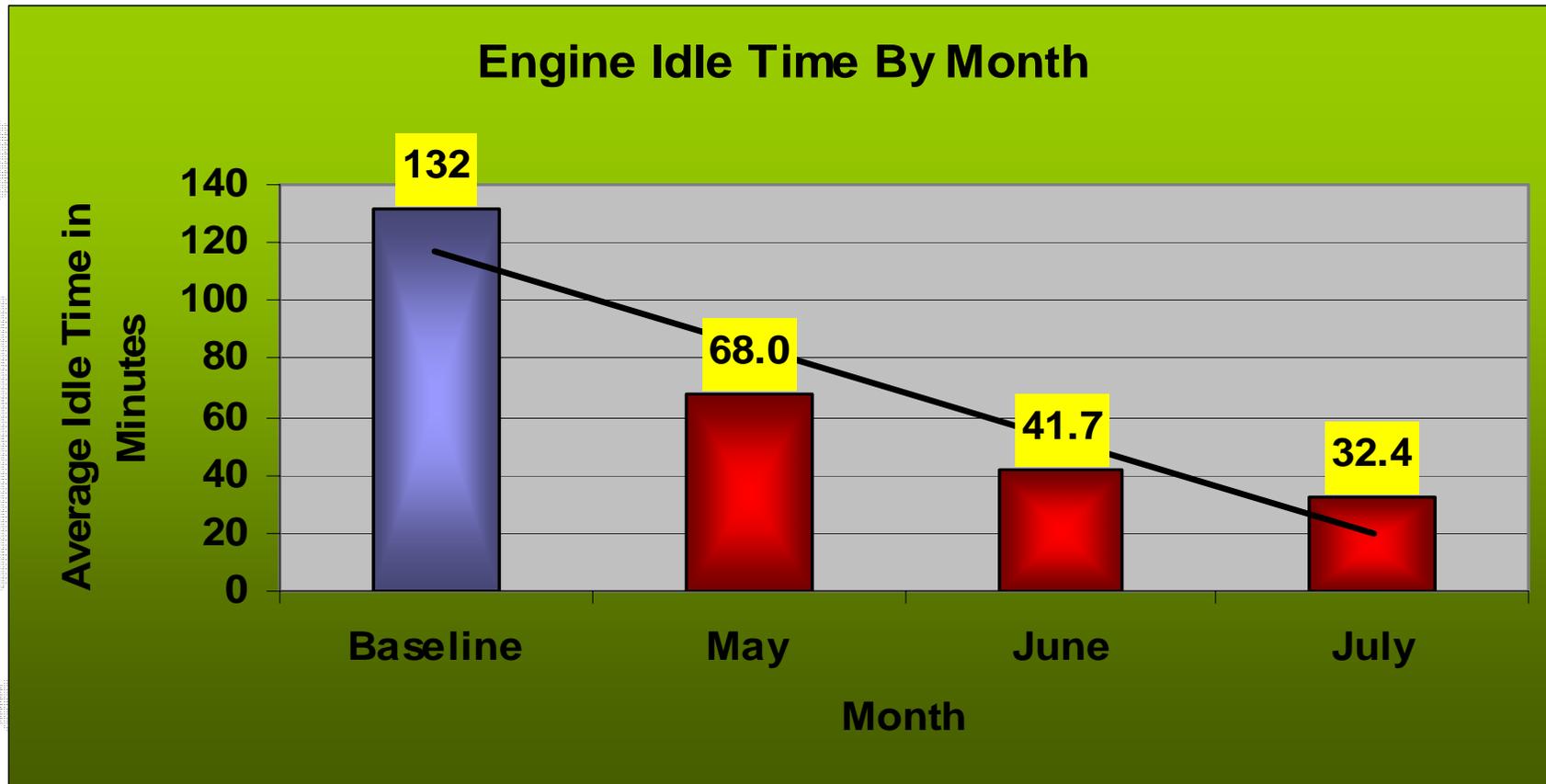
Vehicle: RM-iDEN
 Type: Stop Count



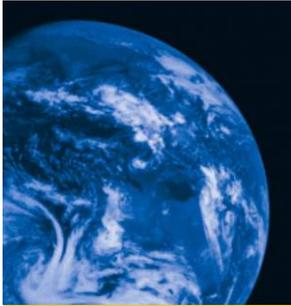


Recent Pilot Data Using Trimble GNSS

(data shown is engine idle minutes/vehicle/day)

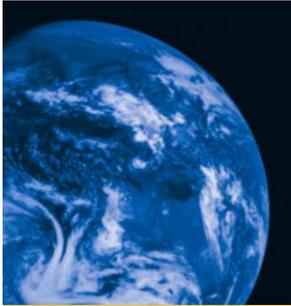


100 minutes/vehicle/day saved between start and end of pilot period.
60 minutes is used in most business cases to be more conservative.



60 Min/Day Idle Reduction Annual Savings

	Vehicles	\$\$\$	Gallons	CO2 lbs.	CO2 Tons
Total US Fleet	20,800,000	\$16,224,000,000	5,408,000,000	108,160,000,000	54,100,000
US Private Company Fleet	16,400,000	\$12,792,000,000	4,264,000,000	85,280,000,000	42,600,000
US Government Fleet	4,400,000	\$3,432,000,000	1,144,000,000	22,880,000,000	11,400,000
Trimble GPS Deployments	200,000	\$156,000,000	52,000,000	1,040,000,000	520,000
Trimble Idle Time Pilots	75,000	\$58,500,000	19,500,000	390,000,000	195,000
Trimble Idle Deployments	5,000	\$3,900,000	1,300,000	26,000,000	13,000



Summary

- **GNSS is a powerful tool for the reduction of anthropogenic GHGs.**
- **Multiple economic sectors can benefit from GNSS and its role in AGHG reduction.**
- **Heavy trucks, Construction activities, and fleet management are just a few examples of where GNSS is being used to reduce AGHGs today.**
- **There are many other areas not mentioned that have tremendous potential: carbon sequestration and process innovation in agriculture**



Questions?

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