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The Economic Benefits of Commercial GPS Use in the United States

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Outline

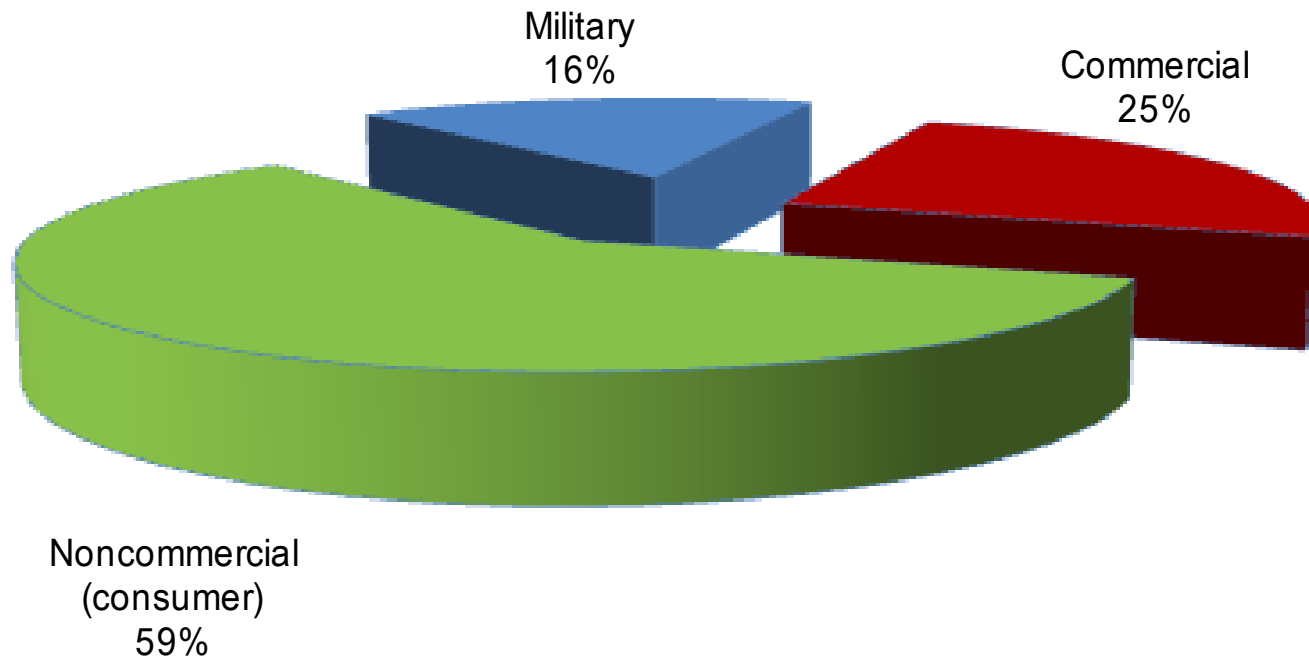
- Development of GPS markets
 - Market segments
 - Revenues, unit, prices
- Economic benefits of commercial GPS to the U.S. economy
 - Precision agriculture
 - Engineering construction
 - Commercial surface transportation
 - Others
- Economic costs of GPS disruption to the U.S. economy
 - Commercial GPS users
 - GPS manufacturers
- Data limitations and next steps
 - Limitations of the existing findings
 - Segments and data to be expanded

GPS equipment sales rose 55% to \$40 billion in five years (\$ billion)

	2005	2006	2007	2008	2009	2010	Growth
Commercial	\$4.686	\$6.538	\$8.719	\$9.980	\$9.353	\$10.298	120%
Ground transport.	1.205	2.145	3.479	4.233	4.085	4.213	250%
Aviation	0.209	0.278	0.314	0.361	0.271	0.325	56%
Machine control	0.320	0.367	0.408	0.443	0.467	0.551	72%
Marine	1.650	2.351	2.978	3.254	2.766	3.254	97%
People-tracking	0.013	0.014	0.016	0.018	0.035	0.060	352%
Precision Ag.	0.480	0.497	0.499	0.490	0.467	0.499	4%
Railway	0.006	0.006	0.006	0.006	0.006	0.006	0%
Surveying/mapping	0.517	0.563	0.673	0.736	0.700	0.833	61%
Timing/Synchron.	0.287	0.317	0.346	0.439	0.558	0.558	94%
Noncommercial (consumer)	\$17.553	\$19.083	\$19.956	\$20.214	\$19.855	\$21.332	22%
Automobile	2.167	3.897	5.050	4.921	3.828	3.587	66%
Converged	15.077	14.815	14.461	14.677	15.409	16.939	12%
Recreational	0.309	0.371	0.445	0.616	0.618	0.807	161%
Military	\$3.240	\$4.255	\$5.282	6.447	6.125	\$7.989	147%
TOTAL	\$25.479	\$29.876	\$33.957	36.641	35.332	\$39.619	55%

Source: ABI Research and authors' estimates

Markets of \$40 billion sales of GPS equipments



Source: ABI Research and authors' estimates

GPS equipments sold rose 75% to 122 millions units in five years (millions)

	2005	2006	2007	2008	2009	2010	Growth
Commercial	1.909	3.054	5.335	6.804	7.287	7.738	305%
Ground transport.	0.612	1.183	2.895	3.998	4.836	4.828	689%
Aviation	0.042	0.050	0.052	0.060	0.045	0.054	30%
Machine control	0.016	0.020	0.025	0.030	0.032	0.042	163%
Marine	1.100	1.650	2.200	2.530	2.151	2.530	130%
People-tracking	0.019	0.022	0.025	0.029	0.059	0.100	427%
Precision Agi.	0.024	0.028	0.031	0.034	0.032	0.038	58%
Railway	0.000	0.000	0.000	0.000	0.000	0.000	0%
Surveying/mapping	0.060	0.063	0.067	0.074	0.070	0.083	39%
Timing/Synchron.	0.036	0.037	0.038	0.049	0.062	0.062	73%
Noncommercial (consumer)	65.239	72.340	83.037	91.597	97.165	109.925	68%
Automobile	2.551	6.057	14.238	18.854	18.553	20.210	692%
Converged	60.942	64.213	66.342	69.604	75.422	85.761	41%
Recreational	1.747	2.070	2.457	3.140	3.190	3.955	126%
Military	2.674	3.045	3.528	4.030	3.828	4.688	75%
TOTAL	69.822	78.438	91.899	102.432	108.280	122.351	75%

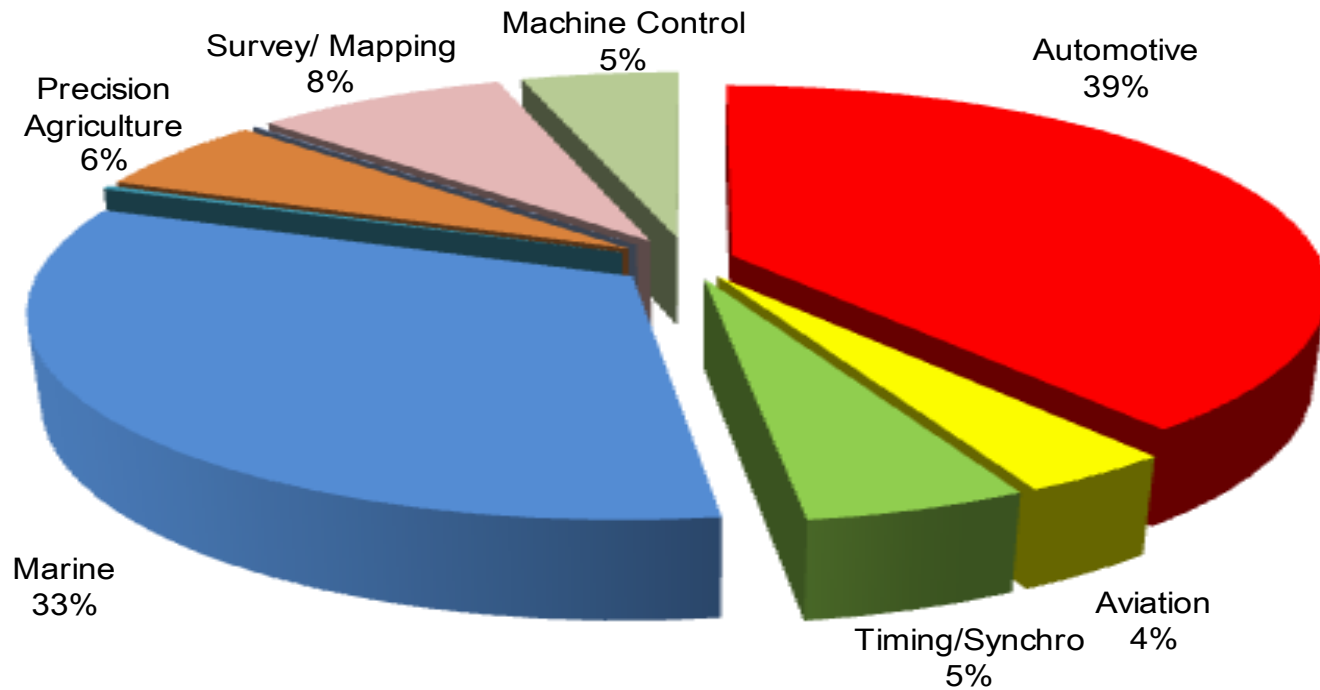
Source: ABI Research and authors' estimates

GPS equipment prices declined 11% over five years

	2005	2006	2007	2008	2009	2010	Growth
Commercial	\$2,454	\$2,141	\$1,634	\$1,467	\$1,283	\$1,331	-46%
Ground transport.	1,968	1,813	1,201	1,059	845	873	-56%
Aviation	5,000	5,500	6,000	6,000	6,000	6,000	20%
Machine control	20,000	18,000	16,200	14,580	14,580	13,122	-34%
Marine	1,500	1,425	1,354	1,286	1,286	1,286	-14%
People-tracking	700	665	632	600	600	600	-14%
Precision Ag.	20,000	18,000	16,200	14,580	14,580	13,122	-34%
Railway	20,000	20,000	20,000	20,000	20,000	20,000	0%
Surveying/mapping	8,600	8,900	10,000	10,000	10,000	10,000	16%
Timing/Synchron.	8,000	8,500	9,000	9,000	9,000	9,000	13%
Noncommercial (consumer)	\$269	\$264	\$240	\$221	\$204	\$194	-28%
Automobile	850	643	355	261	206	177	-79%
Converged	247	231	218	211	204	198	-20%
Recreational	177	179	181	196	194	204	15%
Military	\$1,212	\$1,398	\$1,497	\$1,600	\$1,600	\$1,704	41%
TOTAL	\$365	\$381	\$369	\$358	\$326	\$324	-11%

Source: ABI Research and authors' estimates

Commercial GPS equipment sales double over \$10B in 5 years



Source: ABI Research and authors' estimates

Our analytical framework to estimate economic benefits of GPS

- Bottom-up approach:
 - Estimated productivity benefits (surveys & studies)
 - Cost-savings of GPS on labor, capital, inputs (surveys & studies)
 - GPS rate of adoption (surveys & studies)
 - Revenues/expenditures of the industries (government official data)
- Selected three industries (depicted by data availability)
 - Agriculture
 - Engineering construction
 - Commercial land transportation
- Top-down approach for other commercial industries

Nearly \$20B benefits to crop farming per year

	Annual Value (\$ billion)	60% Adoption: Annual GPS Benefits (\$ billion)	100% Adoption: Annual GPS Benefits (\$billion)
Crop production	\$169.1	\$10.1	\$16.9
10% yields gain			
Savings from affected Input expenses	\$108.4	\$ 9.8	\$16.3
10% Labor wages			
15% Capital (machine & equip.)			
15% Inputs (seed, fertilizers, pesticides, fuels)			
Total		\$19.9	\$33.2
% of total annual production (\$169.1 billion)		11.8%	19.6%
GPS equipments (2010) :			
Sales (\$ billion)	\$0.5		
Units Sold	38,000		
Unit Price (\$)	\$13,000		

Over \$9B benefits to engineering construction per year

	Annual Value (\$ billion)	40% Adoption: Annual GPS Benefits (\$ billion)	100% Adoption: Annual GPS Benefits (\$ billion)
60% Labor wages	\$32.0	\$7.6	\$19.1
30% Capital (machinery & equipment)	\$10.6	\$1.3	\$ 3.2
32.4% Affected input expenses	\$ 2.0	\$0.3	\$ 0.7
Total		\$9.2	\$23.0
% of total annual production (\$245.7 billion)		3.8%	9.4%
GPS equipments (2010)			
Sales (\$ billion)	\$1.1		
Units Sold	97,000		
Unit Price (\$)	\$11,000		

Over \$10B benefits to land transportation per year

	Annual Value (\$ billion)	67.9% Adoption: Annual GPS Benefits (\$ billion)	100% Adoption: Annual GPS Benefits (\$ billion)
11.3% Labor	\$83.0	\$6.4	\$9.4
13.2% Capital	\$21.7	\$1.9	\$2.9
13.2% Raw Materials	\$21.7	\$1.9	\$2.9
Total	\$126.4	\$10.3	\$15.1
% of total annual related costs (\$126.4 billions)		8.1%	12.0%
GPS equipments (2005-10)			
Sales (\$ billion)	\$3.2		
Units Sold	3,100,000		
Unit Price (\$)	\$1,000		

\$122B annual direct benefits to commercial GPS users

	Annual GPS Equipment Spending (\$ billion)	Estimated Annual Benefits (\$ billion)
Precision agriculture (crop farming)	\$0.5	\$19.9 - \$33.2
Engineering Construction (heavy & civil and surveying/mapping)	\$1.1	\$9.2 - \$23.0
Transportation (commercial surface transportation)	\$3.2	\$10.3 - \$15.1
Sub-total (3 industries examined)	\$4.8	\$39.4 - \$71.3
Other commercial GPS users	\$3.5	\$28.2 - \$51.1
Total commercial GPS users in the U.S.	\$8.3	\$67.6 - \$122.4

Other direct and indirect impacts

Other direct impacts

- Health and safety gains in work place

- Worker time savings

- Public safety and emergency response times

- Military, national defense, and public safety

- Quality-of-life improvements from non-commercial GPS consumers

Indirect impacts

- Employment in GPS-related industries and supporting industries

- Large tax base to fund federal and local government expenditures

- Emission reductions from fuel savings

GPS economic benefits of other industries

	GPS Equipment Spending in 2010 (\$ million)	Units Sold
<u>Other Commercial</u>	<u>4,203</u>	<u>2,749,000</u>
Aviation (low spending, high benefits)	325	54,000
Marine (high spending, high benefits)	3,254	2,530,000
Railway (low spending, lower benefits)	6	3,000
People tracking (growing adoption rate, high benefits)	60	100,000
Timing/Synchronizing	558	62,000
<u>Non-commercial</u>	<u>21,332</u>	<u>109,971,000</u>
Automobile	3,587	20,210,000
Converged (mobile handsets, portable electronics)	16,939	85,761,000
Recreational (fitness, handhelds)	807	4,000,000
<u>Military</u>	<u>7,989</u>	<u>4,700,000</u>

Developing Applications Are not Available in the Markets

Suggestions for future work

- Improve estimated economic benefits of industries in our study
 - Detailed yields, adoption rates, cost savings in different regions
 - Meta analysis of existing reports and findings
 - Market surveys of GPS end-users
- Include other GPS industries (commercial, non-commercial, military)
 - Construct data/proxies for yields, productivity, and cost-savings
 - Market surveys of GPS end-users
- Estimate benefits of developing GPS applications
 - Market surveys of products and services
 - GPS manufacturers and target end-users
- Create an information center to compile research, data, applications

About Us

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Annual \$96 billion direct losses of GPS signal disruption

	100 percent Degradation (in \$ billions)	50 percent Degradation (in \$ billions)
<u>Commercial GPS Users</u>	<u>\$87.2</u>	<u>\$43.6</u>
Foregone increased in productivity and cost-savings	\$67.6	\$33.8
Precision agriculture (crop farming)	\$19.9	\$10.0
Engineering Construction (heavy & civil, and surveying/mapping)	\$ 9.2	\$ 4.6
Transportation (commercial surface transportation)	\$10.3	\$ 5.1
Other commercial GPS users	\$28.2	\$14.1
Investment losses in GPS equipment	\$19.6	\$ 9.8
<u>GPS Manufacturers</u>	<u>\$ 8.8</u>	<u>\$ 4.7</u>
Foregone GPS equipment sales	\$ 8.3	\$ 4.1
R&D spending until solution found	\$ 0.5	\$ 0.5
Opportunity costs of R&D spending until solution found	\$ 0.1	\$ 0.1
<u>TOTAL</u>	<u>\$96.0</u>	<u>\$48.3</u>