



Controls and Power Conversion Division

Welcome



Eaton is a leader across the power management spectrum...

We provide reliable, efficient and safe power management for:



Cities & Buildings

Industrial & Machinery

Information Technology

Transportation

Infrastructure

Energy & Utilities



Powering Business Worldwide

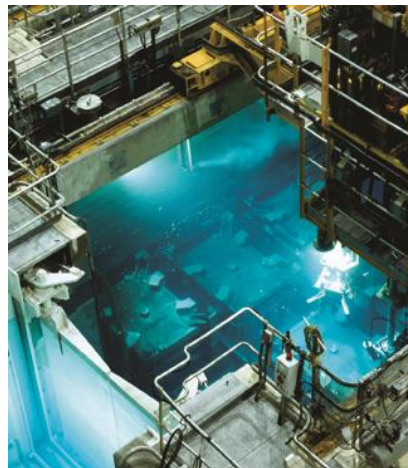
Industrial Conversion Division

Our business delivers energy efficiency, diagnostics and labor saving solutions for the control of low voltage electrical control systems in the following areas:



Building Equipment

- Compressors & Refrigeration
- Cooling towers
 - Air handling
- Escalators / elevators
- OEM / intercompany
 - Solar



Pumping

- Water / waste water treatment
 - Oil and gas
 - Irrigation
- Hydraulic systems



Machinery OEM

- Packaging and processing
 - Material handling
 - Mining machinery
 - Machine tools
 - Paper machinery
 - Rubber and plastic
- Woodworking machinery

ICD Products High Level Overview

Current

Motor Control



Contactors



Electro-Mechanical Starter

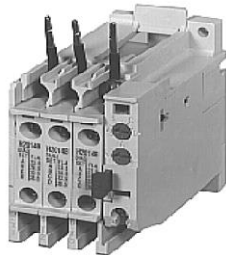


S801/S811 Soft Starter



Drives

Motor Protection



Bi-Metal Overload



*C440 Solid State Overload

*New



*C441 Solid State Overload

*Comms

Simple

Advanced

AC Motors: Power Consumption

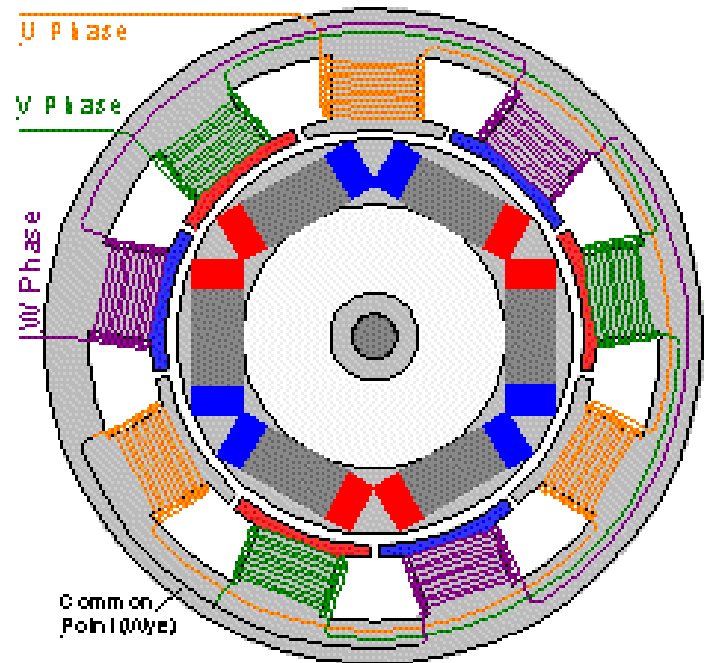
- According to the DOE AC motors utilize:
 - More than 50% of all electrical energy in the US
 - More than 85% of the electrical energy used in industrial production



AC Motors: Poles and Fields

- Electric motors move based on the interaction of magnetic fields.
- AC motors are powered by rotating magnetic fields.

$$RPM = \frac{120 * Driving\ frequency}{Number\ of\ Poles}$$



AC Motors: Speed

- When powered across the line with 60 Hz, motors will run at one speed
- In the past, simple speed control was often achieved by a vent, a throttling valve, or mechanical breaking – all highly inefficient



Building HVAC System



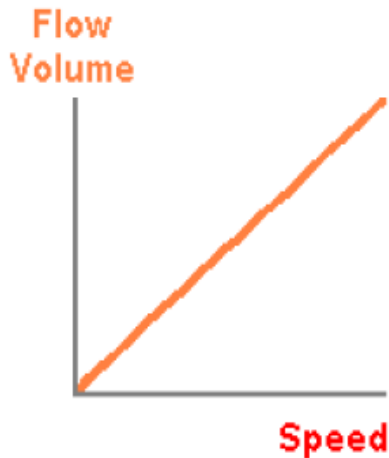
Irrigation System



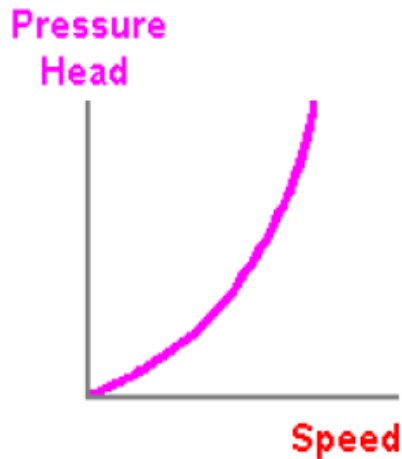
Conveyor Belt System

AC Motors: Energy Savings

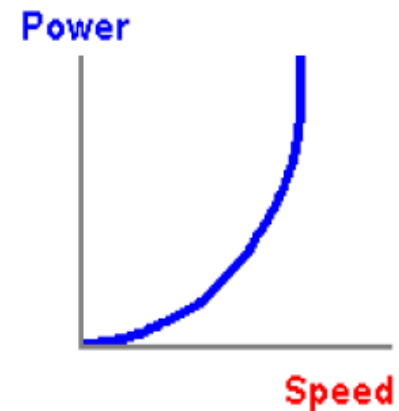
- Flow varies linearly with speed – 50% speed 50% flow
- Pressure varies as square of speed – 50% speed 25% pressure
- Power varies as cube of speed – 50% speed 12.5% power



$$\frac{\text{Flow}_1}{\text{Flow}_2} = \frac{\text{RPM}_1}{\text{RPM}_2}$$



$$\frac{\text{Head}_1}{\text{Head}_2} = \left(\frac{\text{RPM}_1}{\text{RPM}_2} \right)^2$$



$$\frac{\text{Power}_1}{\text{Power}_2} = \left(\frac{\text{RPM}_1}{\text{RPM}_2} \right)^3$$

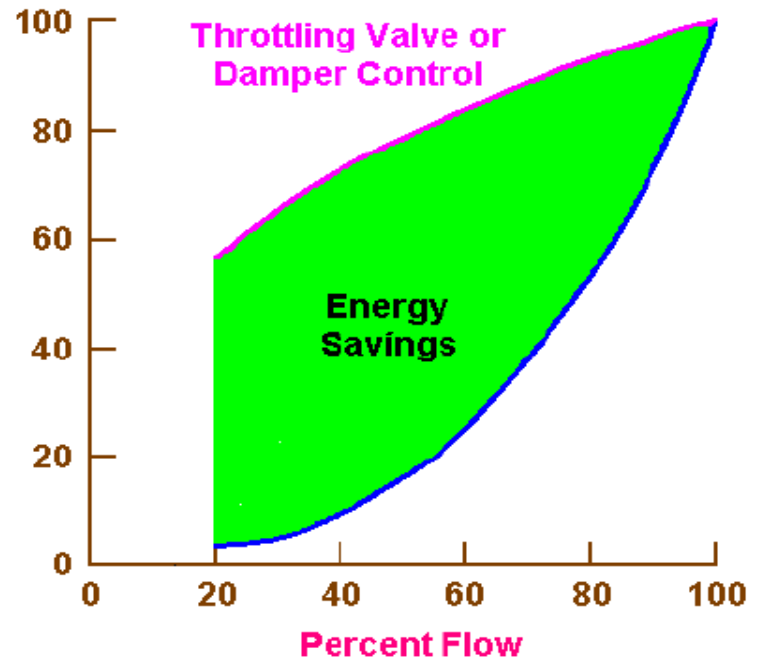
AC Motors: Energy Savings

- Difference in energy usage between a throttle and directly changing the driving frequency of the motor
 - Makes a big difference at lower speeds
- How would we make this happen?



Building HVAC System

Power Consumption

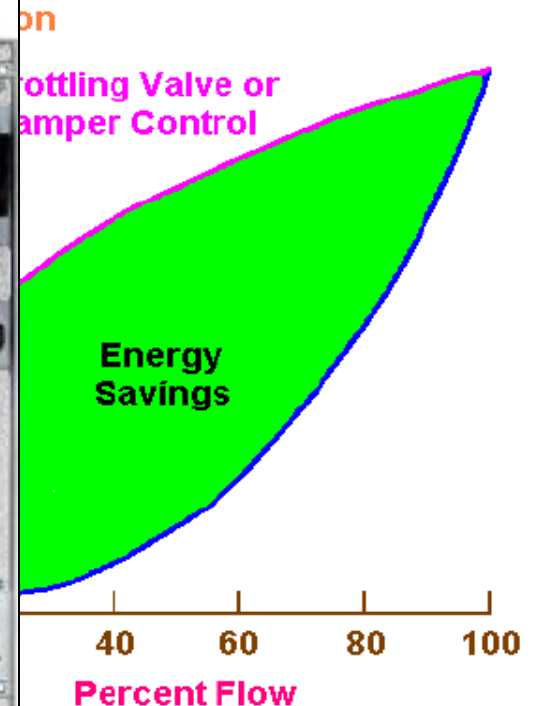


AC Motors: Energy Savings

- Difference in energy usage between a throttle and directly changing the driving frequency of the motor
 - Makes a big difference at lower speeds
- How would we make this happen? – Variable Frequency Drive

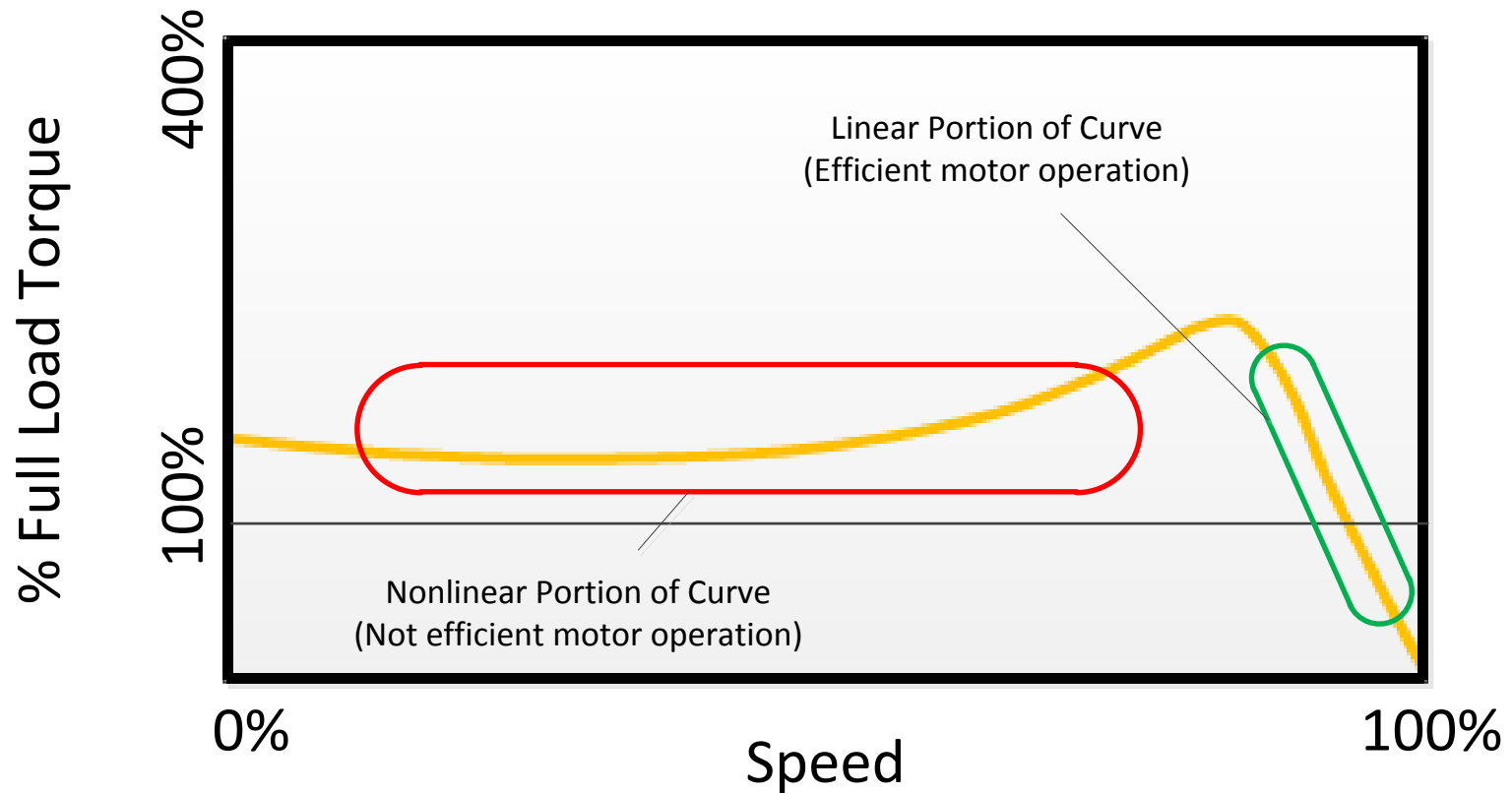


Building HVAC System



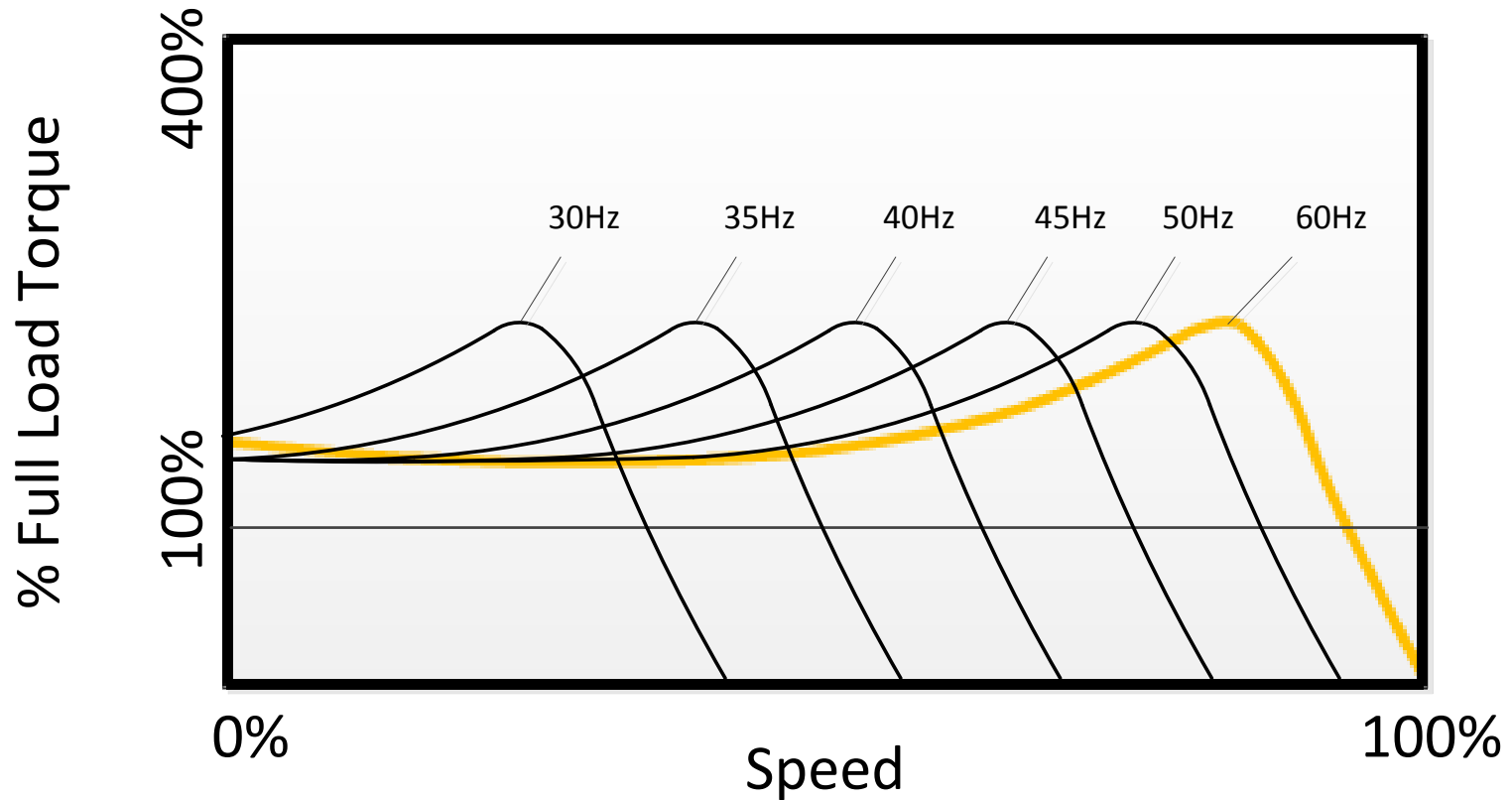
Drives: Basics

- Torque vs. Speed curve at 60Hz – NEMA B motor



Drives: Basics

- Torque vs. Speed curve with VFD

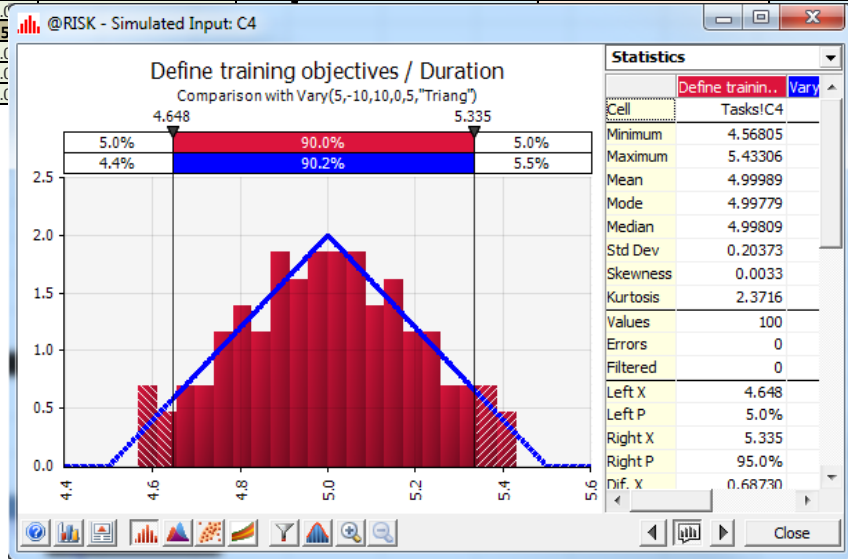


Project Management

- Drive Work Breakdown Structures and Scheduling
- Maintain Project Budget
- Track and Mitigate Risk
- Keep all project stakeholders informed of progress and pertinent updates
- Understand all aspects of the project to ensure that all technical developments teams have the information they need to meet deliverable dates.

Project Management: Global Teams & Scheduling

ID#	Milestone/ Activity	Milestone/Activity Name	Description / Milestone Category	Owner	Duration	Start	Finish	9/19/10	9/26/10	10/3/10	10/10/10	10/17/10	10/24/10	10/31/10	11/7/10	11/14/10	11/21/10
1	Milestone	PC Tool Understanding & Analysis			36.13 days	9/20/2010	11/9/2010	[Gantt bar]									
1.01	Activity	Create Study Report		Pallavi Kaka	7.06 days	9/20/2010	9/29/2010	[Gantt bar]									
1.02	Activity	Impact Analysis		Pallavi Kaka	5 days	9/20/2010	9/24/2010	[Gantt bar]									
1.03	Activity	Update Plan		Pallavi Kaka	1 day	9/27/2010	9/27/2010	[Gantt bar]									
2	Milestone	Artifact Creation						[Gantt bar]									
2.01	Activity	SRS Updation		Pallavi/Vage	1 day	9/28/2010	9/28/2010	[Gantt bar]									
2.02	Activity	Design Document Updation	Menu structure Creation,	Pallavi Kaka	0.5 hrs	9/29/2010	9/29/2010	[Gantt bar]									
2.03	Activity	Test Case updation		Vageesha S S	13.06 days	9/27/2010	10/14/2010	[Gantt bar]									
2.04	Activity	SRS Review			5 days	9/29/2010	10/6/2010	[Gantt bar]									
2.05	Activity	Design Review			3 days	10/6/2010	10/11/2010	[Gantt bar]									
2.06	Activity	Test Case Review			3 days	10/11/2010	10/14/2010	[Gantt bar]									
3	Milestone	PC Tool Implementation						[Gantt bar]									
3.01	Activity	Menu Structure implementation		Pallavi Kaka	3 days	9/27/2010	9/29/2010	[Gantt bar]									
3.02	Activity	Language Support		Pallavi Kaka	3 days	10/6/2010	10/8/2010	[Gantt bar]									
3.03	Activity	Online/Offline Parameterization		Pallavi Kaka	20 days	9/29/2010	10/27/2010	[Gantt bar]									
3.04	Activity	Firmware Version Support		Pallavi Kaka	5 days	9/29/2010	10/6/2010	[Gantt bar]									
3.05	Activity	Update to Service File Info		Pallavi Kaka	1 day	10/6/2010	10/7/2010	[Gantt bar]									
3.06	Activity	Update to start up Wizard		Pallavi Kaka	10 days	10/6/2010	10/20/2010	[Gantt bar]									
3.07	Activity	Unit Testing		Pallavi Kaka	5 days	10/20/2010	10/27/2010	[Gantt bar]									
3.08	Activity	Code Review		Pallavi Kaka	5 days	10/20/2010	10/27/2010	[Gantt bar]									
3.09	Activity	Issue Fixing		Pallavi Kaka	9.06 days	10/27/2010	11/9/2010	[Gantt bar]									
3.10	Activity	Integration in One Installer		Pallavi Kaka	2 days	10/27/2010	10/29/2010	[Gantt bar]									
4	Milestone	PC Tool CSI						[Gantt bar]									
4.01	Activity	Functional Testing		Vageesha S S	1 day	10/29/2010	11/1/2010	[Gantt bar]									
4.02	Activity				0.5 hrs	11/1/2010	11/1/2010	[Gantt bar]									
4.03	Activity				1 day	11/1/2010	11/2/2010	[Gantt bar]									
4.04	Activity				5 days	11/2/2010	11/9/2010	[Gantt bar]									



Project Management: Project Budget

- Resource hours for all disciplines
 - Design/development, testing, drafting, industrialization, Etc.
- Capital expenditures for Project
 - Test equipment, manufacturing equipment, tooling, new building
- All engineering and Introduction Expenses
 - Certification testing, samples, shipping, marketing/advertising, external licensing, etc.
- Projected sales, product cost, and attrition of old product
- Operating profit, net income, years to payback, and NPV of project

Project Management: Project Key Risks

Risk	Mitigation Plan
<p><u>Certification/Marketing Requirements</u> - Potential failure of certification testing in development at marketing specified levels – impacting sales by XXX% of potential growth</p>	<p>Identify appropriate levels where unit will pass certification testing via simulation at outset of project.</p>
<p><u>Supply Chain Management</u> - Sole sourcing of critical components (pricing, supply, etc.)</p>	<p>Ensure cost protection with long term contract. And identify fall back suppliers with fastest development time</p>
<p><u>Development Testing</u> - EMC testing of components.</p>	<p>Development team to work closely with vendors to identify best practices for eliminating EMC with their components.</p>

Project Management: Inform Project Stakeholders

- Taking accurate/pertinent meeting notes
 - Distributing to applicable parties
- Monthly status updates to Sr. MGMT team
- “Gate Reviews” of the project with DGC members:
 - Go, Go Conditional, No Go, Kill verdict selected based on update.

Project Management: Understand All Aspects

- **Mechanical**
 - Housing development and part manufacturing
 - Wire harness design
 - Shock & vibe/environmental testing
- **Electrical**
 - PBC design & component ratings
 - CT design and manufacturing
 - Agency Certifications – UL, CUL, IEC, C-TIC, ATEX, Marine, etc.
- **Software**
 - Software, firmware, and control design and development
 - Full system and user interface testing
- **Industrialization**
 - First run production prototyping
 - Manufacturing processes and required capital investments
- **Initial Sales and Marketing Efforts**
 - “Marketing blitzes” and sales force integration efforts

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