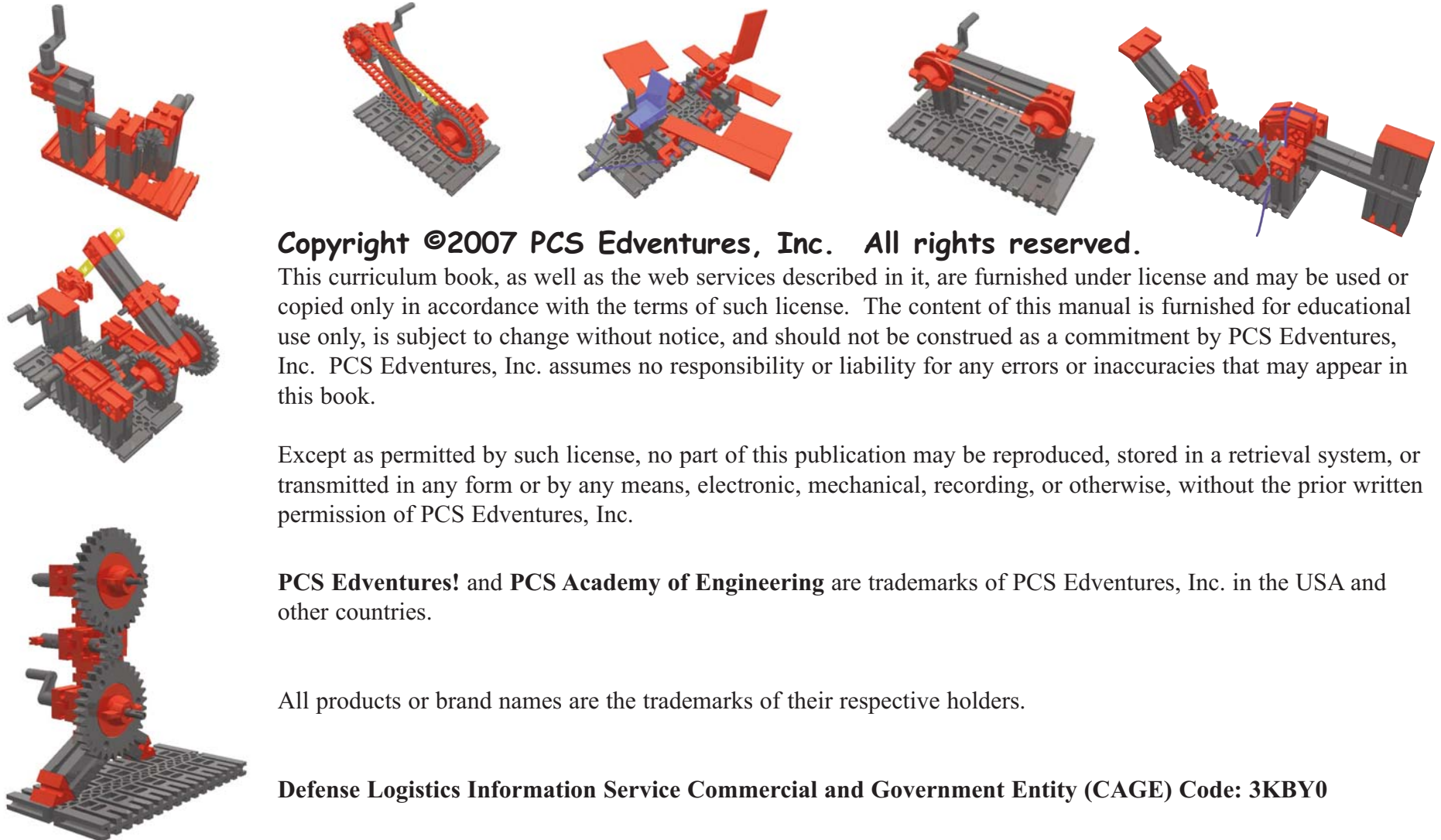


**Power Transfer Series
Teacher's Edition**

COPYRIGHT NOTICE



Copyright ©2007 PCS Edventures, Inc. All rights reserved.

This curriculum book, as well as the web services described in it, are furnished under license and may be used or copied only in accordance with the terms of such license. The content of this manual is furnished for educational use only, is subject to change without notice, and should not be construed as a commitment by PCS Edventures, Inc. PCS Edventures, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in this book.

Except as permitted by such license, no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, recording, or otherwise, without the prior written permission of PCS Edventures, Inc.

PCS Edventures! and **PCS Academy of Engineering** are trademarks of PCS Edventures, Inc. in the USA and other countries.

All products or brand names are the trademarks of their respective holders.

Defense Logistics Information Service Commercial and Government Entity (CAGE) Code: 3KBY0



PROGRAM OVERVIEW

The *PCS Edventures!*TM Academy of Engineering empowers students to learn the basic foundations of Mechanical Engineering, Structures and Architecture, and Software Engineering by completing an exciting array of hands-on activities.

Academy students complete physical, tangible projects, the outcomes of which are relevant to the real world setting of the Academy learning lab. Unlike many computer-based or Internet-delivered programs, the Academy of Engineering compels students to turn away from the computer and build models, design experiments, and solve problems in a challenging, fun atmosphere.

THE POWER TRANSFER SERIES

- **ME102 - Introduction to Power Transfer Systems:**

Provides basic skills and understanding of power transfer systems. Students become familiar with different power transfer systems including belt and chain drives, idler gears, and universal joints. Projects cover the advantages and disadvantages of each system as well as key terminology to all transfer systems.

- **ME202 - Complex Power Transfer Systems:**

Provides a continued examination of power transfer, and focuses on non-linear systems. Students expand their scope of power transfer systems to include "bending" power through a 90-degree angle and flexible, non-linear cable systems. Projects introduce new concepts, terms, and two new gear types — the crown and bevel gear.

- **ME302 - Power Transfer through Offsets and Rotating Levers:**

Introduces students to non-conventional power transfer systems, and focuses on offsets and levers. Students explore the methods of power transfer using offsets, offset and sliding pivots, and levers. Building on previously learned concepts, students build walking machines, intermittent power transfer models and other non-conventional power transfer systems.

- **ME402 - Independent Study of Power Transfer Systems:**

Provides students with the opportunity to apply all of their knowledge in an intensive, personalized research and design project. Students apply their knowledge to the design and creation of a complex power transfer model of their own design. The student model should include, but is not limited to, a belt or chain drive, universal joint(s), crown and/or bevel gears, and structural concepts from other disciplines.

SUGGESTIONS FOR TEACHING

Each Academy of Engineering unit has the same basic components which are designed to be used in the order presented. However, as you become more comfortable with the materials, you will find that the activities can be used in any order to meet your teaching style and the students' needs. Whether in ME102 or ME402, the components of the modules in each course are Preparation, Background, Project 1, Project 2, Challenges, and a Personal Project. The last unit in each course includes a long-term group project called a Cooperative Challenge. Assessment and student portfolio building is done using the Academy of Engineering Online Assessment Website (www.edventures.com/aoe). Quizzes have been provided to use as unit assessment if desired.

Preparation: This section gives you a brief overview of the unit, itemizes the materials needed for Projects 1 & 2, and presents preparation tips for the unit.

Background: This section provides vocabulary terms and the background information of the unit. We recommend you read it before teaching. Terms can be looked up using the Term Library accessed at the PCS Edventures website. "Wow" is an introductory class activity provided for you to capture student interest in the topic and to demonstrate the basic principles covered in the unit.

Project 1 and Project 2: These projects introduce the principles and skills needed to master the topic. The three major sections to the projects are the:

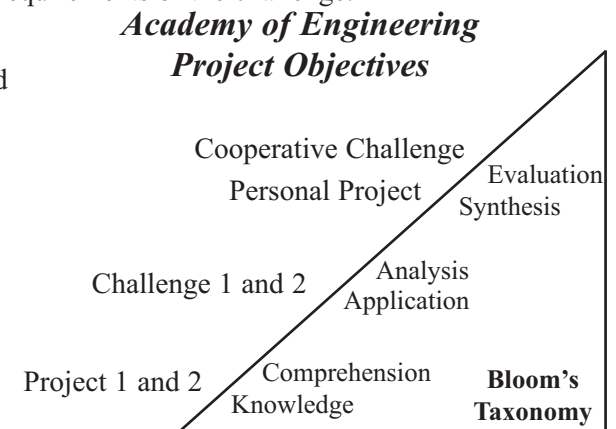
1. "Make sure you have:" section listing the materials;
2. "Build..." section giving the building procedures;
3. "Try this..." section providing the assessment questions and activities.

In the "Make sure you have:" section, lists of materials are presented with pictures for ease of use. The "Build..." section includes text and step-by-step instructions for the project. The "Try this..." section is intended to be used with the Online Assessment process within the Academy of Engineering Online Assessment Website (academy.edventures.com). Student answers should be recorded on their copy of the project page, then recorded online when convenient. The Answer Key is in the Appendix.

Challenges: Each module includes two challenges. These are open-ended activities designed to assess the student's ability to apply the principles learned in Projects 1 and 2. Few instructions or hints are given, and the student is allowed greater latitude in meeting the requirements of the challenge.

Personal Projects and Cooperative Challenges: These are synthesis activities. Students should be encouraged to reflect on the content and processes they have learned by doing the projects and challenges. Their personal and cooperative projects should demonstrate their mastery of the material.

The objectives of the components are intended to correspond with the levels of Bloom's Taxonomy shown to the right.



Power Transfer Series Table of Contents

ME102 - Introduction to Power Transfer Systems

ME102 UNIT 1: BELT DRIVE

Preparation	1
Standards Alignment.	2
Background.	3
Project 1: Build a Belt Drive	4
Project 2: Stress-O-Matic	6
Challenge 1: Dual Belt Drive	10
Challenge 2: Conveyor Belt	10
Personal Project	11

ME102 UNIT 2: CHAIN DRIVE

Preparation	13
Standards Alignment.	14
Background.	15
Project 1: Build a Chain Drive	16
Project 2: Chain-Driven Trolley	19
Challenge 1: Conveyor II	23
Challenge 2: Chain Drive Buggy	23
Personal Project	24

ME102 UNIT 3: IDLER GEARS

Preparation	26
Standards Alignment.	27
Background.	28
Project 1: Not So Idle Idler Gears	29
Project 2: Vertical Idler.	32
Challenge 1: Egg Beater	36
Challenge 2: World's Longest Idler Gears	36
Personal Project	37

ME102 UNIT 4: UNIVERSAL JOINTS

Preparation	39
Standards Alignment.	40
Background.	41
Project 1: Amazing Universal Joint	42
Project 2: Up and Over.	46
Challenge 1: Universal Drive Shaft	49
Challenge 2: Oscillating Fan	49
Personal Project	50
Cooperative Challenge	52

ME202 - Complex Power Transfer Systems

ME 202 UNIT 1: 90 DEGREE TURNS

Preparation	54
Standards Alignment.	55
Background.	56
Project 1: Crowning the Corner	57
Project 2: Bevel to Bevel	60
Challenge 1: Tight Turns in a Helicopter	62
Challenge 2: Racing with 90 Degree Turns	62
Personal Project	63

ME 202 UNIT 2: FLEXIBLE SYSTEMS

Preparation	65
Standards Alignment.	66
Background.	67
Project 1: Flexible Power Transmission.	68
Project 2: Long Distance Power Transfer.	73
Challenge 1: Pinball Flipper.	78
Challenge 2: Flexible Excavator.	78
Personal Project	79
Cooperative Challenge	81

Power Transfer Series Table of Contents

ME302 - Power Transfer through Offsets and Rotating Levers

ME 302 UNIT 1: OFFSETS AND ROTATING LEVERS

Preparation	83
Standards Alignment.....	84
Background.....	85
Project 1: Offset Lever	86
Project 2: Intermittent Power	90
Challenge 1: Crankset.....	97
Challenge 2: Hole Puncher.....	97
Personal Project	98
Cooperative Challenge	100

ME402 - Independent Study Power Transfer Systems

ME 402 UNIT 1: COMBINED POWER TRAIN

Preparation	102
Standards Alignment.....	103
Background.....	104
Project One: Combined Drive	105
Project Two: Flashy Chassis.....	112
Challenge One: Power Transfer Vehicle.....	122
Challenge Two: Ultimate Power Train.....	122
Personal Project	123
Cooperative Challenge	125

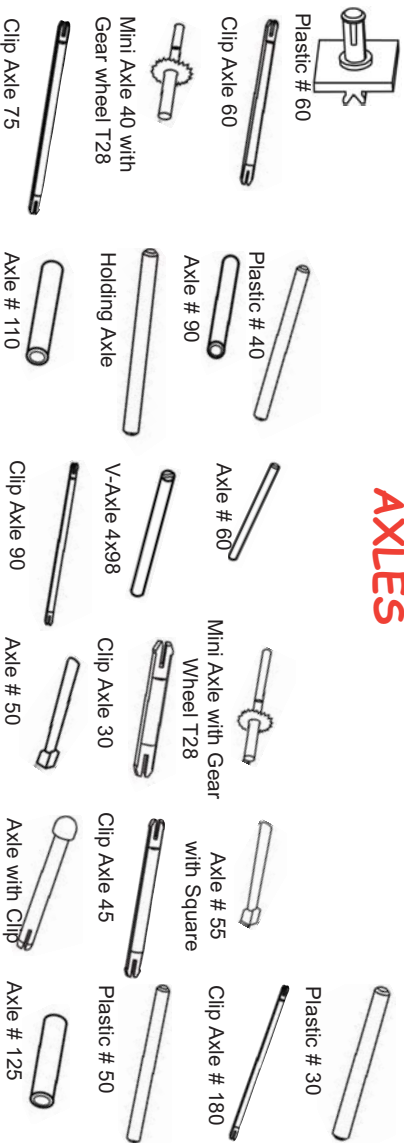
Appendix

Teacher “Try This” Answer Key	127
Alignment with National Science Standards	133
Alignment with Project 2061 Benchmarks.....	134
Quiz Copy Masters	135
Quiz Answer Keys	143

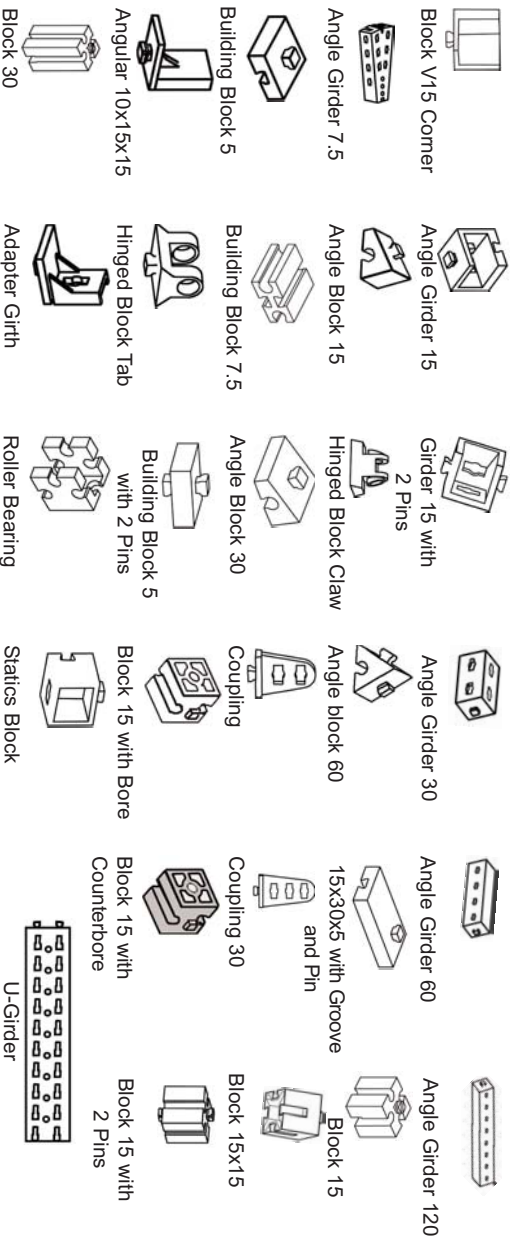


NOMENCLATURE

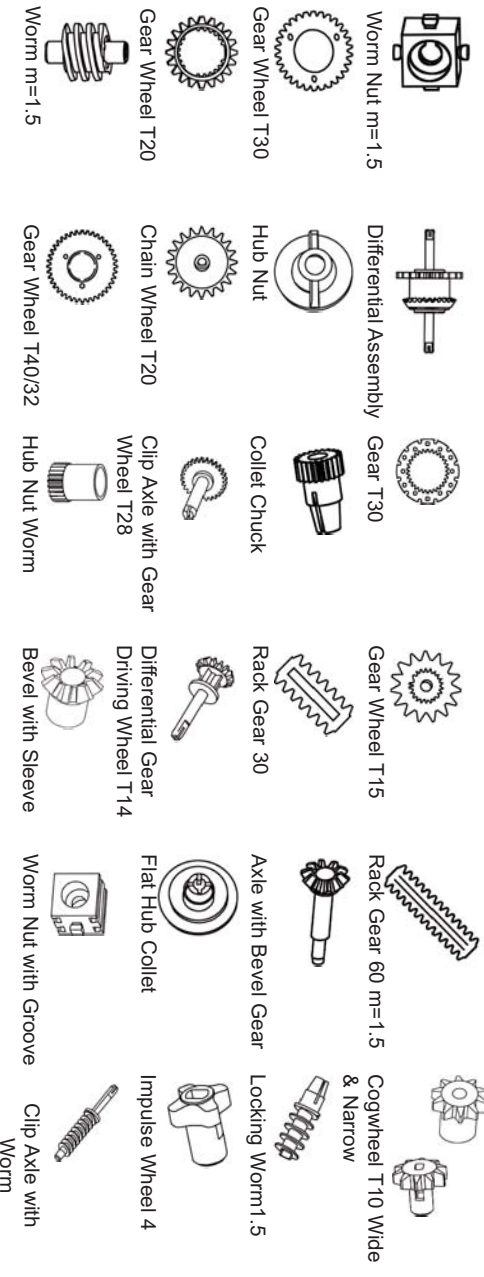
AXLES



BLOCKS & GIRDERS

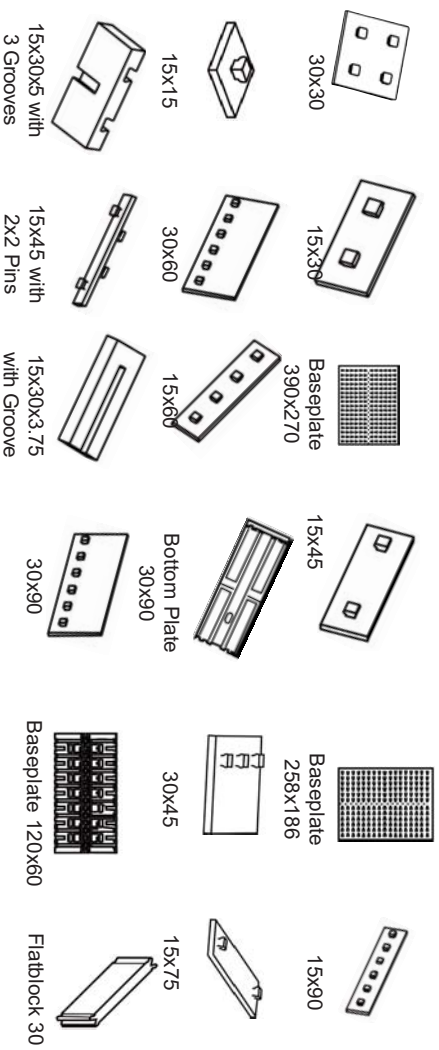


GEARS

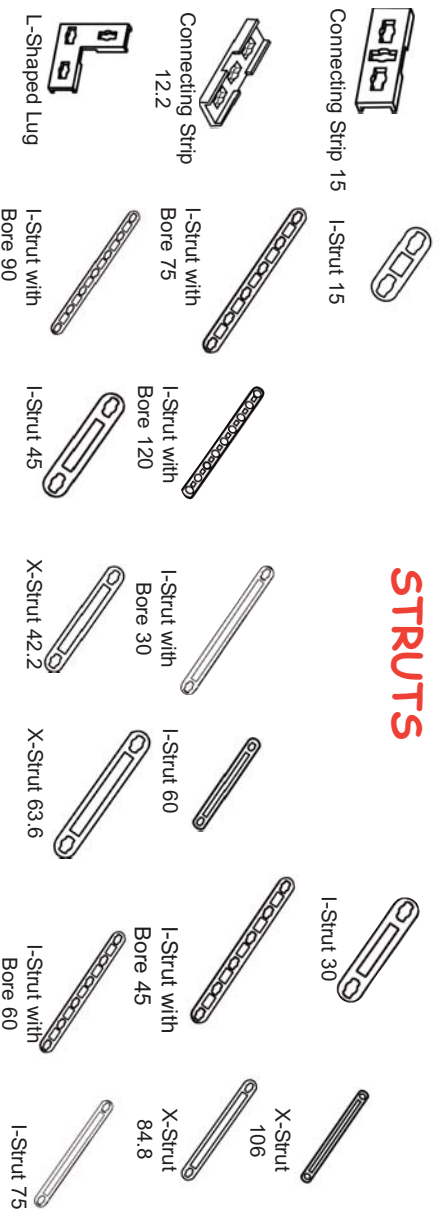


NOMENCLATURE

PLATES



STRUTS



MISCELLANEOUS

