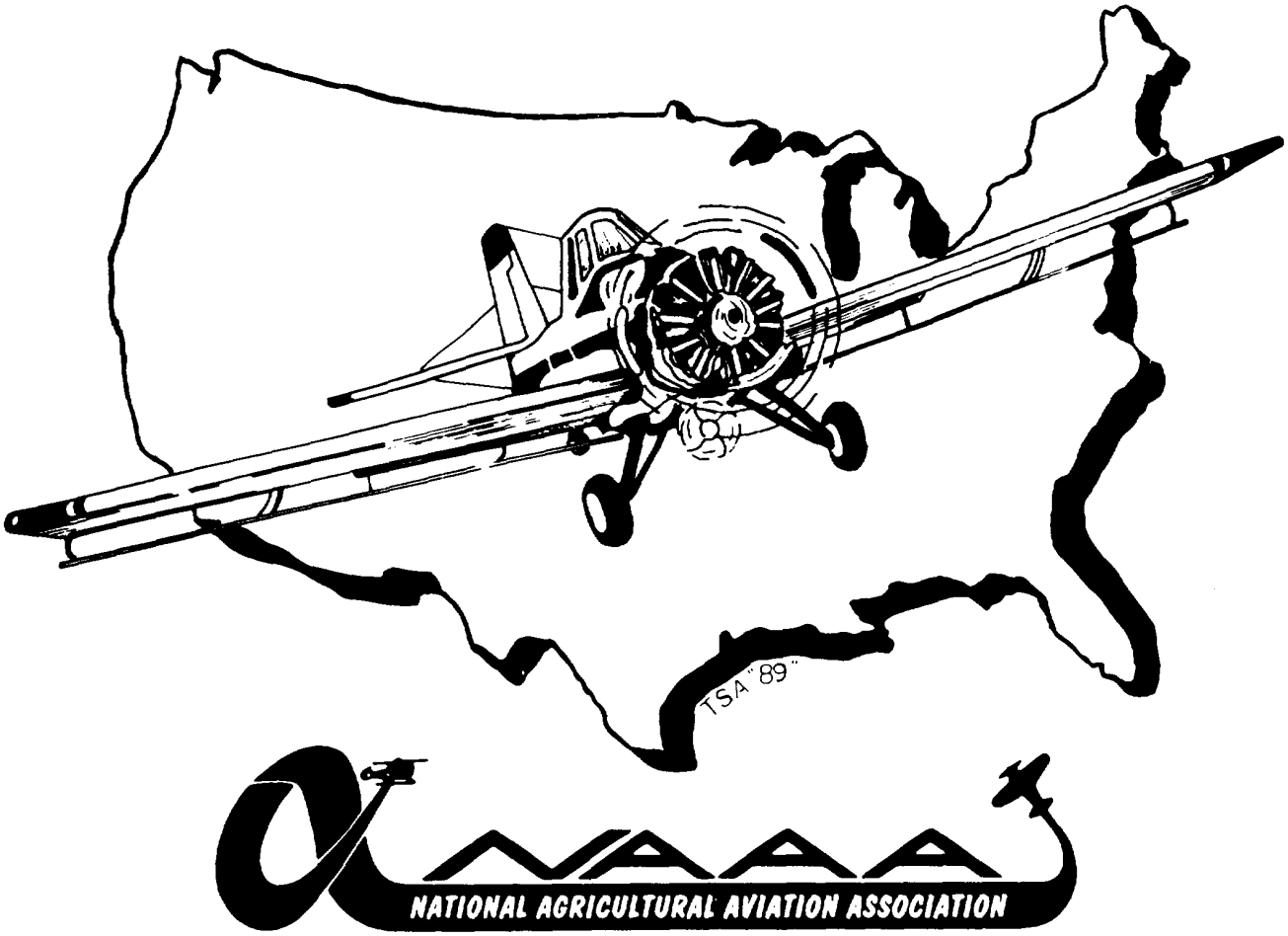
U.S. Department
of Transportation

**Federal Aviation
Administration**



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ELEMENTARY LEVEL EDUCATIONAL CURRICULUM GUIDE

AGRICULTURAL AVIATION
ELEMENTARY LEVEL EDUCATIONAL CURRICULUM GUIDE

AGRICULTURAL AVIATION: Critical Assist for the World's Food Supply

Elementary Education Curriculum Guide Presentation Outline

1. The intent and purpose of the elementary agricultural aviation curriculum guide.

    A. To introduce the service industry of agricultural aviation to educators and students.

        1. The history of agricultural aviation.
            a. The development/need for the service in agriculture.
            b. The evolution of the industry.
        2. The agricultural aviation industry as it exists today.
            a. The people involved in agricultural aviation.
            b. The importance of the industry to agriculture (forestry, disease control)
        3. The future of agricultural aviation.
            a. The role it plays in the continued production of food and fiber.

    B. To provide insight into the usefulness and importance of agricultural aviation.
        1. Agricultural aviation assists the growers of food and fiber.
            a. Agricultural aviation impacts the lives of people through the food they eat and the clothes they wear.
        2. Agricultural aviation provides service to federal, State and Local Governments.
            a. The industry assists in protecting the forests, therefore affecting the shelter of many people.
            b. When called upon, the agricultural aviation industry assists in controlling in- sects considered health threats.

    C. To ensure people understand the environmental and safety concerns of agricultural aviators.

    D. To provide accurate and current information for other education specialists and programmers to utilize when teaching about the industry.
        i. Entities such as National Aviation & Space Administration, Civil Air Patrol, federal Aviation Administration, Ag in the Classroom (United States Department of Agriculture) utilize the curriculum guides.

II. The development of the elementary agricultural aviation curriculum guide.
    A. Developed by the Women of the National Agricultural Aviation Association.
        1. Educators assisted in the development.
        2. The National Agricultural Aviation Association approved the concept and c ontents of the guide.
        3. The National Agricultural Aviation Research & Education Foundation funded the project.
    B. The guide contains accurate and current information about the agricultural aviation industry.
        1. The WNAAA and NAAA Education & Public Relations Committees will update the information as necessary.

III. The recommended procedure for educators to follow.
    A. Become familiar with the contents of the guide.
    B. Obtain appropriate supplemental material from resource listing.
    C. Integrate the information into existing lessons.
        1. Enhance the existing lessons.
        2. Provide realism to lessons.

IV Kindergarten, Grade 1 and Grade 2 Contents

A. Pretest
B Activity sheets for students with teacher directions written in goals & objectives.
1. The information about agricultural aviation addresses the student's needs of food, shelter and clothing.
2. Identities subject areas with which to integrate the information.
3. Contains listing of vocabulary & suggested speakers.

V. Grades 3, 4, and 5 Contents

A. Pretest
B. The guide integrates the information about agricultural aviation into the subject areas of Geography, Community, Health Language, Mathematics and Science.
   1. Contains teacher directions written in goals and objectives for each subject area.
   2. Contains reproducible student worksheets for each subject area.
   3. Contains reproducible student supplemental sheets to enhance the lessons.

VI. Resources & Materials Listing

A. Listing of sources from which to obtain additional information.
   1. Listings under Agriculture, Agricultural Aviation, Aviation, Environment & Pesticides
   2. Suggested local speakers which provide community and school interaction.

VII. Critique

A. Contains critique for educators to complete.
   1. Provides information for instituting changes in curriculum guide.
   2. Gives a basis to determine if the curriculum guide should be continued.

AGRICULTURAL AVIATION:
Critical Assist for the World's Food Supply

CONCEPT: The Agricultural Aviation industry is critical to the continued production of the worlds food supply.

INTRODUCTION: Agricultural Aviation has become a necessity in the economic production of quality food. To aid in ensuring the existence of this industry, the National Agricultural Aviation Association was organized in 1967. Included in the organization's purpose is the objective of educating the public about this evolving industry in which 2,200 operators utilizing approximately 6,700 agricultural aircraft, are affecting the entire population of this country with their services in the areas of agriculture; federal, state, and local government; and the recreational industry.

In agriculture, aerial applicators are assisting growers in crop production management by seeding and fertilizing; controlling diseases, insects and weeds, and applying growth regulator, desiccants and defoliants. For ranchers, aerial application is an economic method of controlling livestock insect and pasture weeds; managing grasshopper infestations on rangeland; and selective snow melting. The industry is also involved in feeding and relocating fish. As an agricultural support system, aerial applicators are aiding in the production of an abundance of high-quality food and fiber.

*Under national, state or local government contracts, Ag aviators employ their aircraft to perform varied services which are essential to the nation's well being. Ag pilots are involved in: public health programs, including mosquito abatement; controlling fire, insects and disease in forests; eliminating cultivated and wild illegal plants; right-of-way brush control; and environmental cleanup such as oil spills. This aspect of agricultural aviation deals with maintaining the aesthetic, health, and safety standards to which the American public is accustomed.

Ag pilots and their aircraft are occasionally called upon to enhance the quality of leisure/recreational activities. They provide services to golf courses for snow removal, banner and glider toeing operations, and air show promoters. These tasks are not necessities for living but involve other ways to utilize the pilots and aircraft of the industry.

Although agricultural aviation is a diverse industry, its primary purpose is to economically assist in the production of the world's food and fiber supply. With a better understanding of the role Ag aviators play in supplying food, perhaps the general public will realize how critical this industry is to their existence.

SUGGESTED USAGE OF THIS CURRICULUM GUIDE:

This guide contains current and accurate information about the agricultural aviation industry. The hands-on design or practical approach allows for and encourages flexibility. The designated grade levels serve only as a suggested entry point for instructors. Special education instructors (EMH, SLD, Speech and Language Clinicians) and teachers of the gifted and talented can easily utilize the information for their students. classroom teachers may find it suitable material for a substitute teacher to present.

The education guide approaches the topic of agricultural aviation from the agricultural angle since it affects the daily lives of the students through their basic needs of food, shelter and clothing. The areas of aviation, pesticides and environment need consideration to give the students a complete and accurate view of the role of aerial application in providing food and fiber for everyone.

Please complete and send the critique form. The National Agricultural Aviation Association relies on your evaluation to improve the educational guide. We appreciate your interest in our industry and your efforts to promote agricultural aviation as a critical assist to the continued production of the world's food supply.

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INTRODUCTION: For Teachers of Kindergarten, Grade 1 and Grade 2

Agricultural aviation is a new concept for many of the children enrolled in kindergarten, grade I and grade 2. Yet, it is an industry which directly affects their daily lives.

There are two parts to the industry - the 'agricultural' aspect and the 'aviation' aspect. The 'agricultural' side is utilized to show the students what the industry involves and how it affects them. The 'aviation' side is usually an exciting topic to students and warrants attention. Excellent materials about aviation are available to teachers of all grades. Sources for these are given in the materials and resources listing.

The guide is intended only as an information source to follow, do not allow it to stifle any creative thinking. If the students are interested in a specific area please spend more time on it.

The information about agricultural aviation is presented to the students by using coloring and activity sheets with goals and objectives written for each sheet. Supplemental sheets and suggested speakers are referenced in the presentation outline. It may be beneficial to read the section for grades 3, 4 and 5 for more detailed and specific information about some aspects of the industry. Sources for additional materials about agricultural aviation are contained in the materials and resources listing. These, are well as your own life experiences or prior knowledge about the agricultural aviation industry, are helpful to expand on the information contained in the guide.

The play "Andy the Ag Plane" is an activity to enhance the student's understanding of the agricultural aviation industry. They are able to participate by making the characters, acting out the parts as the instructor reads the play or changing the play to make it more suitable for the area of the , country in which they live.

Before beginning it is suggested that a 'pre-test' be administered. To do this, ask the students to draw a picture of what they think agricultural aviation is. (The term crop spraying, crop dusting, or Ag spraying are synonymous with agricultural aviation and may be substituted for it.) Record what percentage of the students knew what agricultural aviation was or save the pictures to compare with drawings done as a post-test after the students have been exposed to current and accurate information about the agricultural aviation industry.

INSTRUCTIONS FOR TEACHERS OF KINDERGARTEN, GRADE 1 AND GRADE 2 TO USE WITH ACTIVITY SHEETS 1 THROUGH 6.

Activity Sheet No. 1

Goal: The students will understand the relationship which exists between the food they eat and agricultural aviation.

Objective No. 1: The students will understand the importance of food to every living being and specifically to humans.

The students should be able to provide answers to the following questions.

I. Why do all living beings need food?
2. Why do you need food?
3. Are all foods good for us? (candy, pop, 'junk food')
4. What kinds of foods are better for us? (refer to top left pictures)
5. What are the 4 basic food groups?

Vocabulary: nutrition, survival

Language Skills: categorization, listening, speaking, understanding shapes Subject Areas: Health, Science, Language

Speakers: School Nurse, Nutritionist

Objective No. 2: The students will understand what a rural area is and the importance of agriculture or farming to the production of food and fiber.

The students will understand that food and fiber are produced in rural or less populated areas where farm land, pasture and forests exist.

1. Talk about necessity of soil to raise crops in and explain that although a city has soil most of it is covered by buildings and streets.
2. Expand their knowledge so they realize that very few plants can grow in the mountains or the desert. (plants require proper moisture, temperature, nutrients and sunlight)
3. On a map of your state show them areas that have the soil and climate to produce food and fiber products. Do the same with a map of the United States and then a map of the world. Name the important farming areas known for their rich soil. (Red River Valley, San Joaquin Valley, Ukraine)
4. Have the students tell of their experiences with growing a plant or assisting with the family garden. (watering, weed control, insect problems)
5. Have the students color the farm/rural scene and create a story about it.

Vocabulary: rural, agriculture, fiber, soil, climat e, rancher, producer, farmer, grower

Language Skills: listening, speaking, writing

Subject Areas: Science, Geography, Language, Handwriting

Speakers: Flood or Fiber Producer, Agronomist, County Extension Agent

Objective No. 3: The students will learn about the equipment and practices that food and fiber producers utilize to help them in their operations. (what local producers use and those that produce a crop grown outside your region)
The students should realize that farming practices have changed dramatically since this country was settled. Hand labor is not the current method used to economically produce the vast quantities of quality food and fiber.

1. Present pictures of the methods once used to farm. Name some of the early pieces of equipment - hoe, pick, horse drawn planters, plows, early cotton gins, early threshing machines.
2. Explain that most families produced what they ate. They preserved the food by canning or storing underground. (There were no refrigerators, freezers, meat processing plants, paved roads for transporting food great distances) The families only sold or traded the food they were unable to utilize themselves.
3. Present pictures of modern equipment utilized by today's food and fiber producers. Supply names for the equipment - combine, 4-wheel drive tractors, swather, cultivator, etc. Have the students make comparisons of the modern and outdated equipment.
4. Today each food and fiber producer feeds 114 people. That means that the farms are larger and the equipment is larger. Some hand labor is still used, to weed the crops or pick the produce, but machines have replaced much of the hand labor. Equate the 114 people to 4 or 5 classrooms of 20 students each. Explain that in 1978 each American farmer produced enough food and fiber for 56 people; in 1950, 25 people; and in 1910, 7 people.
5. Agrochemicals are also used to assist the food and fiber producers. These have been developed in the last 40 to 50 years to control plant diseases, insects and weeds. To get optimum production from the land fertilizers are also used.
6. Have the students color the lower left-hand picture.

Vocabulary: farm implements (as many as you can supply pictures for), acre
Language Skills: memory (naming equipment), listening, writing (names of equipment)
Subjects: History, Science (understanding preserving foods), Handwriting
Speakers: Implement Dealer (or contact one nearby to get brochures), Grower

Objective No. 4: The students will learn that Agricultural Aviation is a tool that food and fiber producers use. (picture number four)

The students should understand that farmers/growers/ranchers rely on agricultural aviation to help them by: seeding and fertilizing; applying pesticides to control weeds, insects, diseases, and to dry down the plants in order to harvest them. Agricultural aviators perform a service for the growers, much like a nurse (who gives an injection after the doctor determines what is wrong), or a house painter (who paints a house after the homeowner determines when, and what color, to paint).

1. The main piece of equipment an aerial applicator uses is an aircraft (airplane or helicopter). Talk about other service people, the job they perform and the equipment they would use. (painter-paint brush)
2. Some facts the students may like to know about the aerial application industry include: Agricultural Aviation began in 1921 in the state of Ohio (discuss how long ago it was and where Ohio is located); in the early years of agricultural aviation, dry chemicals were spread on the crops to control insects - the name "crop dusters" came into being; crop dusting was a somewhat dangerous career since the airplanes used were not necessarily built for that purpose; today the "crop dusters" are called "aerial applicators", "Ag sprayers" or "spray pilots" and work in the industry of agricultural aviation; the aircraft used today (both airplanes and helicopters) are built for the purpose of crop spraying; and there are many rules and regulations to follow in the industry. (supplemental sheet no. 1)
3. Have the students compare the early crop spraying airplanes and the modern agricultural aircraft. Have them identify differences and color the pictures. (supplemental sheets no. 7, no. 8, no. 9)
4. Talk about pesticides that aerial applicators use and why they are used.
   a. Pesticide is the broad term given to a product which controls pests. Most people have pesticides ill their homes - fly sprays, roach motels, chlorine tablets for swimming pools, flea and tick collars for pets, etc.
   b. An 'Insecticide' is a product used to control harmful insects. If they have gardens they put out powders and sprays to keep the insects from harming the vegetables. Aerial applicators apply insecticides on crops for the same reason or else the insects would damage the crops which would result in less food produced.
   c. A 'Herbicide' is a product used to control weeds which take valuable sunlight, moisture and nutrients away from the food and fiber plants. Have they ever noticed weeds, especially dandelions, in their lawn? The weeds can choke out the grass and you have patches of weeds, not grass.
   d. A 'Fungicide' is a product which controls plant diseases. Vegetable crops are susceptible to diseases as well as grains, sugarbeets, beans and fruit. If not controlled, the disease would kill the plants and no food would be produced.

e. 'Desiccants' or 'Defoliants' are products which dry down or destroy the foliage of plants. These are used to aid in the harvesting of crops.

5. Discuss the reasons Ag pilots are called upon to assist the growers - faster, more economical, can get to remote areas, since they fly above the crop there is no crop damage, if it is wet the grower can't get into the field, some products can only be applied by commercial operators (which most spray pilots are), some products are labeled to be applied only by aircraft.

6. How does aerial application tie in with the basic need of 'food'?

Vocabulary: aerial, application, pesticide, herbicide, fungicide, desiccate, insecticide, defoliant

Subject Areas: Health, Language, Science, History

Speakers: Aerial Applicator, Agrochemical Dealer, Aircraft Manufacturer (for the name of an aerial applicator in your area contact the NAAA)

Activity Sheets No. 2A and 2B

Goal: To understand why agricultural aviation is important in the production of foods in the bread and cereal group.

Objective No. 1: The students will understand that growers of cereal crops use the services of agricultural aviators.

The services provided (at various stages of growth) include seeding (rice), fertilizing, controlling weeds, insects, and diseases; and desiccating or defoliating. Although only wheat is pictured at various stages of growth, the students should be informed that other cereal crops (rice, barley, rye, oats, etc.) follow similar growth patterns and require protection from pests (weeds, insects, disease) so they can grow to maturity and be harvested.

1. Direct the students to look at the eight pictures on activity sheet 2A. Ask the students what they can tell you about the pictures.
   a. Explain what the pictures show: a seed; planting and fertilizing (which aircraft's can do); young wheat plant with roots showing below the soil surface; rain and sunshine (important for plant growth and development); weeds controlled by herbicides which may be applied by aerial applicators; a growing wheat plant; insects controlled by insecticides which may be applied by aerial applicators; a mature wheat plant.
   b. The students can color the pictures and cut them out.
   c. The students can practice sequencing the pictures.
2. To illustrate the various stages of growth plants go through, the students could plant seeds in containers and monitor their growth. This project could be done with flowers which could be sent home to parents.
   a. To make comparisons, plant a group of seeds, then 2 weeks later plant another group and so on. The students can then compare one stage to another.
   b. To illustrate how weeds are competitive with the planted crop, plant a number of seeds of a different kind in a container which has a number of growing and thriving plants (which will be the weeds for this illustration). Note that the larger plants shade the smaller plants, and utilize the moisture and soil nutrients more easily because of a more developed root structure.
   c. To illustrate the damage harmful insects can do, simulate the chewing an insect does on the plant during the various stages of growth (on seedlings cut them off at soil level, take leaves off more mature plants, cut the buds off on flowers ready to blossom, etc.)
3. Discuss what happens if aerial applicators:
   a. Were not available to seed a food crop such as rice.
   b. Were not available to fertilize a food crop such as rice.
   c. Were not available to assist with the control of weeds which take nutrients, sunlight, and moisture away from the planted crop.
   d. Were unable to spray for the insects in the cereal crops because the weather was bad (wind blew, rained).
   e. Could not spray pesticides which controlled plant diseases.
   f. Did not exist.
4. Ask the students what the pictures on sheet 2A illustrate.
   a. Depending upon the grade level, the students may be able to write about the 'sequence of events' the pictures represent or add pictures to the sequence for further detail.
5. Discuss the pictures on sheet 2B. The top row illustrates the route the harvested crop takes prior to processing (harvesting or combining - transporting to storage - storing at growers facility, selling to a livestock operation where it is fed to livestock or selling to an elevator where it is stored then sold - transporting for sale to another country or to a processing plant). The bottom row illustrates from processing to eating (processing at a plant where food crop is made into edible products - transporting to a retail store such as a grocery store - selling at grocery store - eating by consumer).
   a. Explain to the students what wheat can be made into. If possible obtain wheat kernels and grind them into flour. Explain that years ago flour was ground up by the bakers

(or housewives) themselves, it did not go to processing plants. Also tell the students about the use of flour sifters which were used years ago to sift the bugs out of the ground flour. Today people do not need to use flour sifters because of better methods of controlling the insects during growth and storage.

b. Talk about the length of time it takes for the process to occur (from the time the seed is planted to the time the processed food product is eaten).

c. Inform the students that a similar sequence is followed for vegetable, fruit and nut crops which are processed (canned), dairy products, and meat products.

d. Direct the students to color the pictures on 2B and cut them out on the dividing lines. These pictures can be added to those from 2A and the students can practice sequencing all 16 of them.

6. For enrichment determine what careers are related to each picture. (supplemental sheet no. 6)

a. Ask the students if the careers of their parents or relatives are related to agricultural aviation or to agriculture.

Vocabulary: career, names of various careers, sequence, flour sifter, wheat
Subjects: Science, Community, Health
Speakers: Person in a career related to agriculture, grain or cereal producer

Activity Sheet No. 3

Goal: The students will understand the importance of agricultural aviation to fruit and vegetable producers

Visual: A helicopter is applying a pesticide to a "fruit tree" which has a number of difficult fruits growing on it. Vegetable crops are also being treated with a pesticide applied by a helicopter. Pictured below are various fruits and vegetables large enough for the students to color. The wholesome produce was treated with pesticides to control diseases, insects and weeds. The inferior looking produce was not treated for diseases, insects or weeds.

Objective No. 1: The students will be able to distinguish the inferior looking produce from the high quality produce.

1. After realistically coloring all the objects in the picture you may ask the students to circle the poor quality items. Ask the students to explain why they think the worms and blemishes are present on some of the fruit. Inquire which fruits and vegetables the students would be more willing to eat.

Objective No. 2: The students will gain knowledge about the role of agricultural aviation in the economic production of high quality fruits and vegetables.

1. Ask the following questions:
   a. Would you eat an apple if you knew it had a worm in it?
   b. What would you do with the wormy apple?
   c. Should the apple man try to sell wormy apples?
   d. What should the apple man do with wormy apples?
   e. Should an apple grower sell wormy apples to an apple man?
   f. What should the apple grower do with the wormy apples?
   g. Should an apple grower try to grow apples that don't have worms?
   h. What can an apple grower do to not get worms in his apples?
   i. How can the product (pesticide) which prevents the worms from appearing in the apples be applied? BY AN AGRICULTURAL AVIATOR
2. Do the same sequence with various fruit or vegetable crops.
3. For enrichment learn about the life cycle of the worm which loves to live in apples.

Vocabulary: pesticide, insecticide (etc.) "high quality", blemishes, orchard
Subjects: Health, Science
Speakers: Fruit or Vegetable Producer, Agricultural Aviator

Overview Of Activity Sheets No. 1, No. 2 and No. 3

The students should know that agricultural aviation is an important service that food producers utilize. The bread and cereal, and fruit and vegetable food groups were highlighted and the meat- nut protein, and milk groups were integrated under bread and cereals (the dairy animals, and livestock used as a meat source, eat processed cereal crops and many pesticides are aerially applied to pastureland).

Additional activities which relate agricultural aviation to the daily lives of the students include:

1. Discuss the source of all of the food items on a pizza and how each has had the benefit of the services provided by an agricultural aviator.

   Pizza crust - the dough is made from flour which is made from *grain, vegetable oil is made from *vegetables and milk from **dairy cattle.

   Pizza toppings - *onions, *green peppers, *olives, tomato sauce from *tomatoes, cheese is made from milk which comes from **dairy cattle, hamburger is made from **beef cattle, sausage is made from **pigs, etc.

- received services from an aerial applicator
-their food sources received services of an aerial applicator

2. Talk about the student's favorite foods and what their source is.
3. Discuss what would happen if insects, weeds or diseases were not controlled in food crops.
4. Discuss what it would be like if there was not enough food for everyone to be "full". What if the shelves at the grocery stores were not "full".

Activity Sheet No. 4

Goal: The students will understand how agricultural aviation affects their shelter.

Visual: Sheet no 4. depicts a helicopter spraying trees grown for their lumber as well as other products (paper, pencils, etc.) The lower portion shows a home, dog house, Christmas tree, pencil, paper and book; all products are made from wood.

Objective No. 1: The students will understand where the lumber used in dwellings and other structures comes from.

1. Ask the students the following questions and supply them with the answers if they do not know the correct response.
   a. Where do you live? (In a home, apartment, etc.)
   b. Why do you need to live in a _____? (For shelter from weather, quiet, have a place to leave belongings which is safe, etc.)
   c. What is the _____ you live in made from? (Looking for 'wood')
   d. Do all of you have 'wood' somewhere in your home even though it may not be covered on the outside with wood? (studs, trim, cabinets, garage door, etc.)
   e. Where does the wood come from?
   f. Are there any forests or wooded areas near by? (using a map of the United States show the students where the forests are in this country; talk about tree farms, where Christmas trees are grown; discuss the importance of trees in many recreational areas)

Objective No. 2: The students will know that trees are susceptible to disease, insects and fire and the services of an agricultural aviator are needed to preserve the trees some of which will be cut for lumber as well as other products.

1. Ask the following questions and if necessary supply the correct answers.
   a. Could insects harm trees? Diseases? Fire?
   b. How can the trees be protected from insects? Diseases? Fire?
   c. Could an aerial applicator help in protecting the trees? How?
   d. Do you think the trees should be protected from insects, disease and fire? Why?
2. Tell the students about fire bombers. These are aircraft used to control forest fires by hauling fire retardants or water and dropping it on the fire. (refer to resource listing for book on the subject)
3. Have the students color the pictures on Sheet No. 4 and select a few students to present their colored pictures and explain what they see on the sheet.

Vocabulary: dwelling, wood products, fire bomber
Subjects: Science, Community, Geography
Speakers: Forest Ranger, Owner of a tree farm, Person from wood processing plant

Activity Sheet No. 5

Goal: The students will understand how aerial application is related to the clothing industry.
Visual: The sheet depicts an agricultural aircraft applying a pesticide to cotton. In the middle section are enlarged pictures of a few of the insects which plague the cotton plants. The bottom shows items made from cotton as well as the cotton symbol.

Objective No. 1: The students will know what cotton is used for.

The cotton grown in this country is used to make clothing, sheets, rugs, furniture coverings, saddle blankets, table cloths, towels, cotton balls, etc.

1. Ask the students the following questions:
   a. What have you touched today that was made from cotton? (may have to explain 'cotton', then develop a list or cut pictures from a catalogue to show the number of items which are made from cotton or have cotton plus another man-made fiber)
   b. Have the students look at the tags on their clothing to check the fabric content.
   c. Are there many items you use daily which have cotton in them? What are some of those items?
   d. Can you think of a replacement for these items? (What would you use instead of a towel? What would the clothes you wear (jeans, etc.) be made from?
   e. Do you think we are lucky to have cotton?

Objective No. 2: The students will know where cotton comes from and how aerial application is important to its production.

1. Determine if the students know where cotton comes from. If they do not know supply them with information about the growing cotton: it is grown in the southern states in rural areas by farmers; many insects plague the cotton at all stages of growth; it is harvested by

hand labor or machines; it is put into bales; it is processed and the fibers are used to make cloth which can be dyed different colors; and many products which are used in our every day lives are made from cotton. (a film about the cotton industry would be appropriate)

2. After learning about cotton ask the students if they know why aerial application is important to the production of cotton.
    a. Explain that many insects use the cotton plants to lay their eggs in and the young feed on the bolts which destroys them.
    b. Look at the pictures of the insects in the middle of the sheet. Have the students describe the insects they see there.
    c. Discuss the importance of applying an insecticide to control the insects which harm the cotton plants, and that the services of an aerial applicator are frequently used since the cotton is sprayed more than one time during the growing season because a number of different insects need to be controlled. (Note: Cotton was the first crop treated by aerial application. Airplanes were used to apply an insecticide to control the cotton boll weevils which were destroying the crop.)
    d. Inquire if the students think aerial application is important to the production of cot- ton.
3. Have the students color the pictures on Sheet No. 5. Encourage them to turn their paper over and draw other items which are made from cotton which they come in daily contact with.

Vocabulary: cotton, boll weevil, insecticide, plague

Subjects: Science, Health, Language

For enrichment:

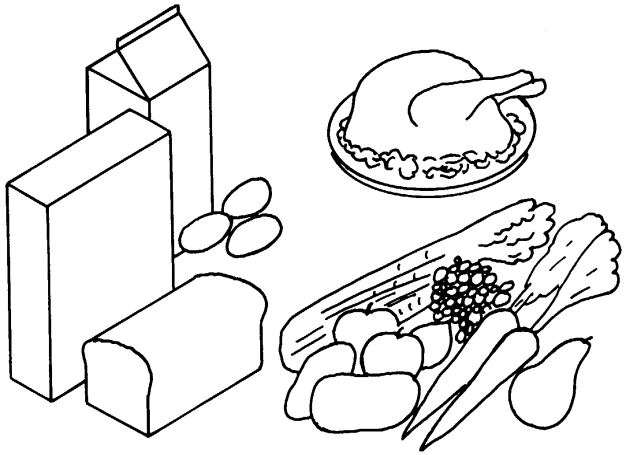
1. Discuss where leather comes from. It also involves aerial application. Shoes, belts, purses, coats - cattle, sheep - grain, corn, pastureland - aerial application.
2. Where do footballs come from? (similar sequence)
3. Study the life cycle of the boll weevil.
4. Study the cotton industry from production to processing.

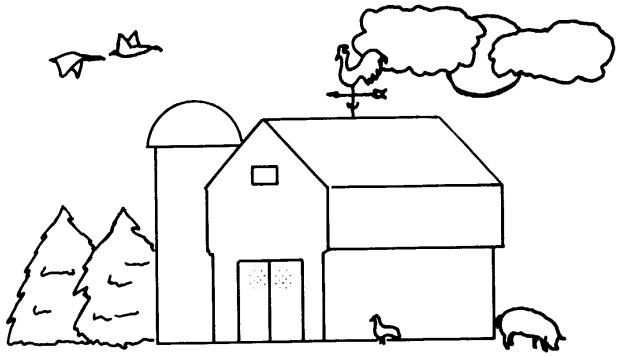
Activity Sheet No. 6

Goal: To draw all the information together and impress upon the students that the industry of agricultural aviation affects their lives.

Visual: The scenes shown in the picture include: the city skyline, a reference to where the majority of the population in the United States lives; a road winding through a rural area where, an aerial applicator is protecting a crop; snow-covered mountains in the distance with a mountain emptying into a lake; and a picnic scene by a lake.

l. Talk about what the students see in the picture. How many of the scenes can the students relate back to the aerial application industry?
2. Have the students add their family to the picnic scene.





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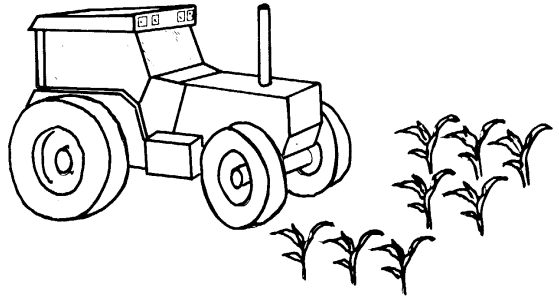
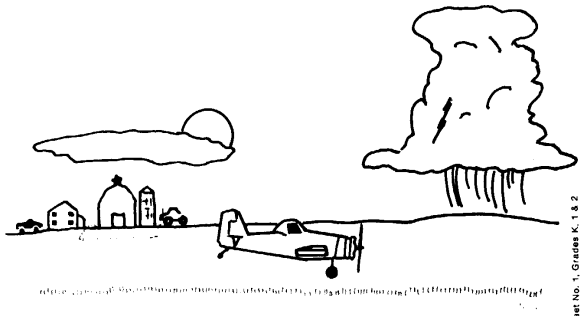
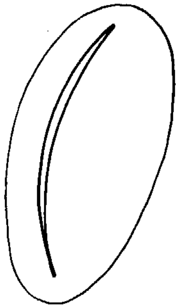
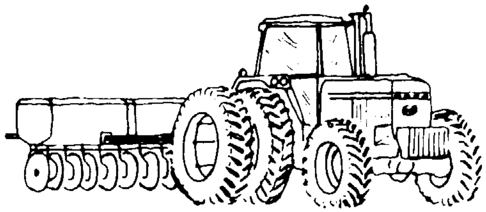


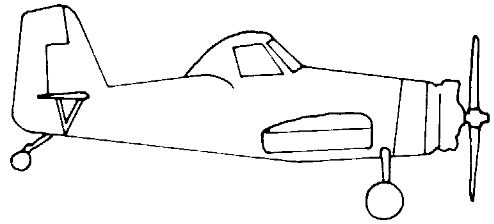


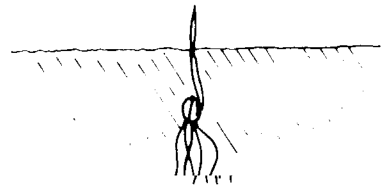
Activity Sheet No. 1, Grades K, 1 & 2

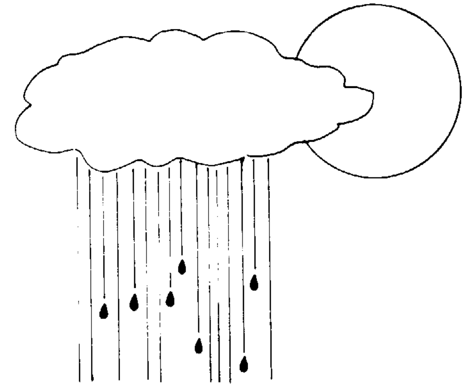
Activity Sheet No. 2A. Grade K, 1 & 2











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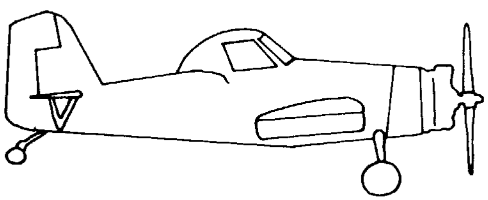

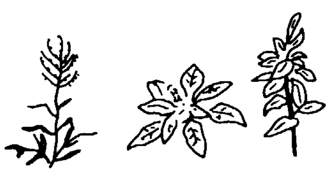

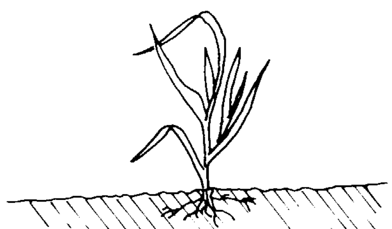

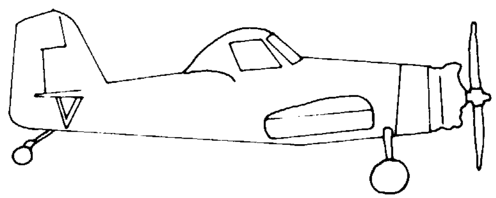

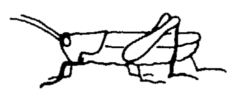

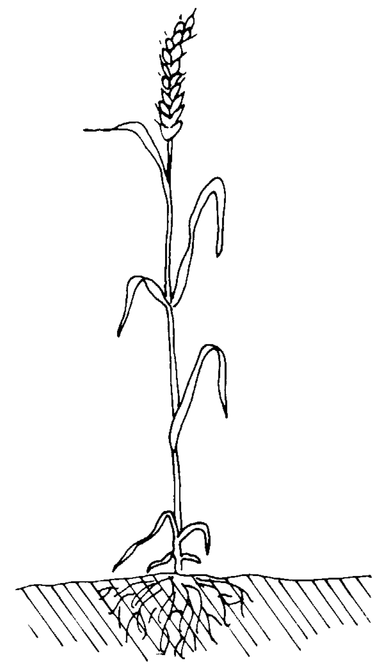

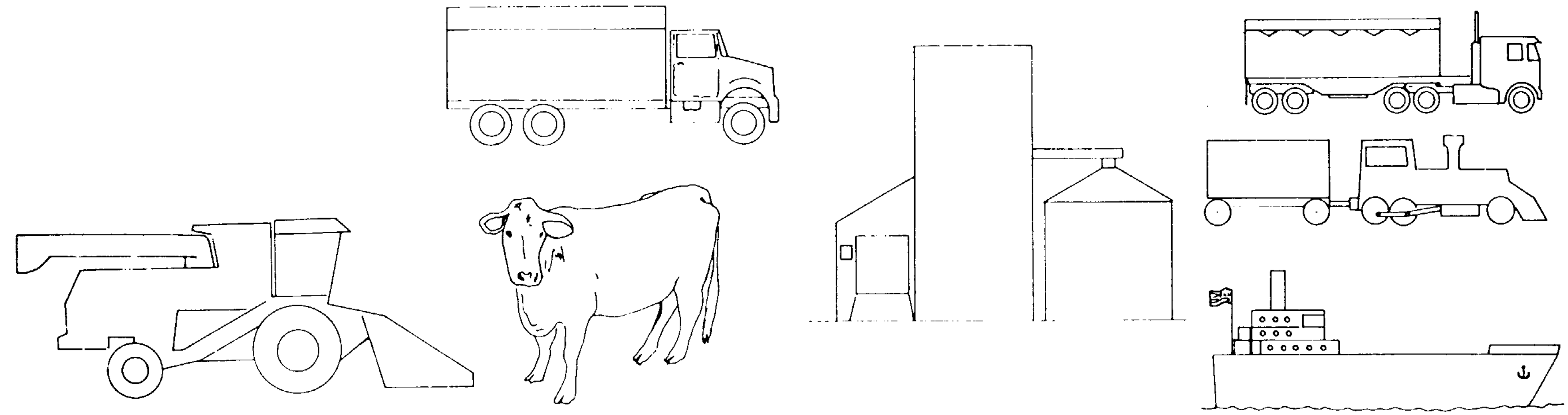

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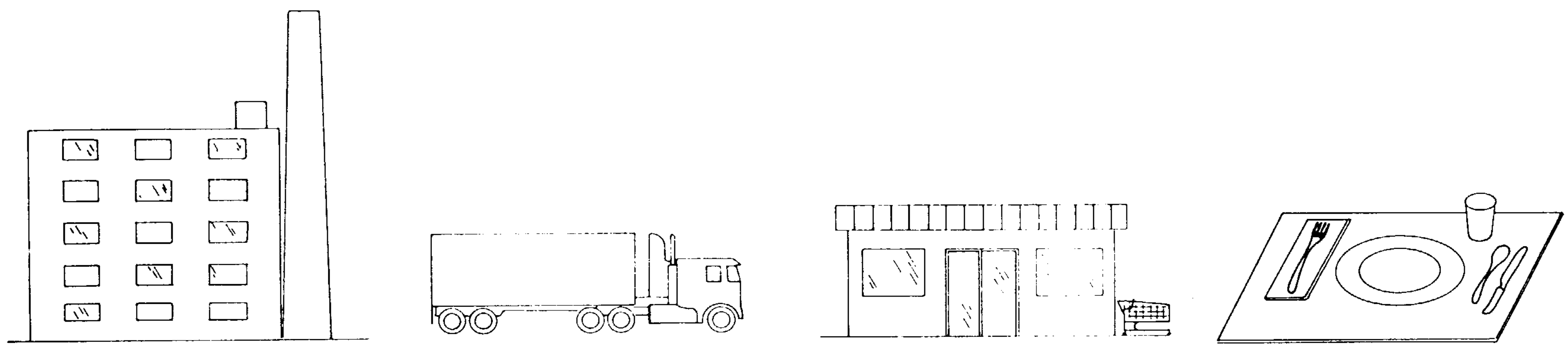
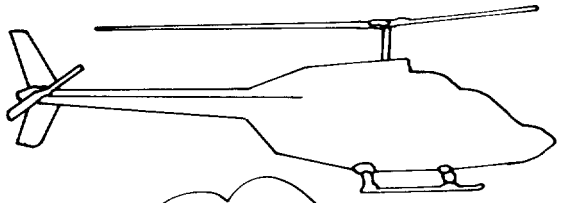
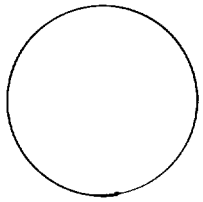
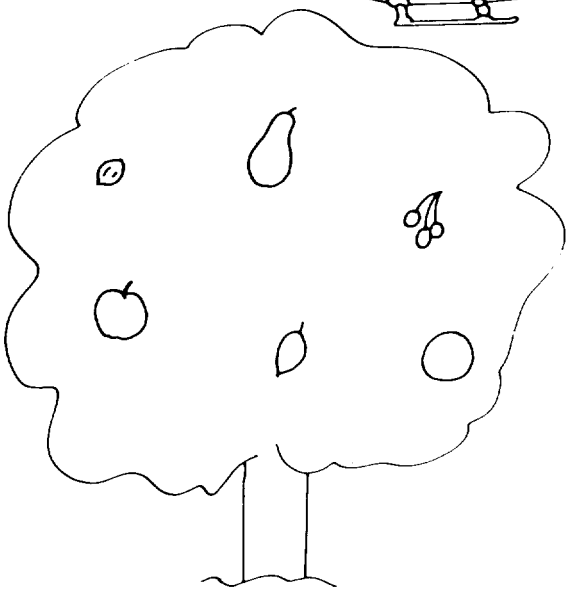
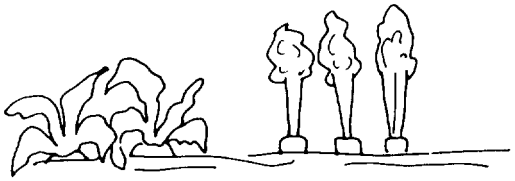


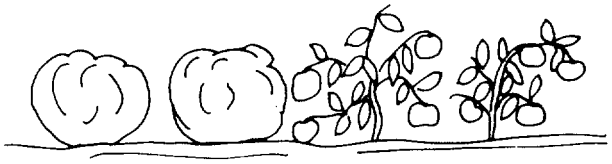
Activity Sheet No. 2B, Grade K, 1 & 2

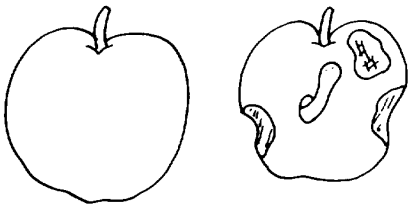


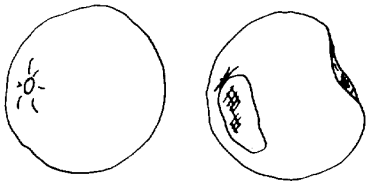


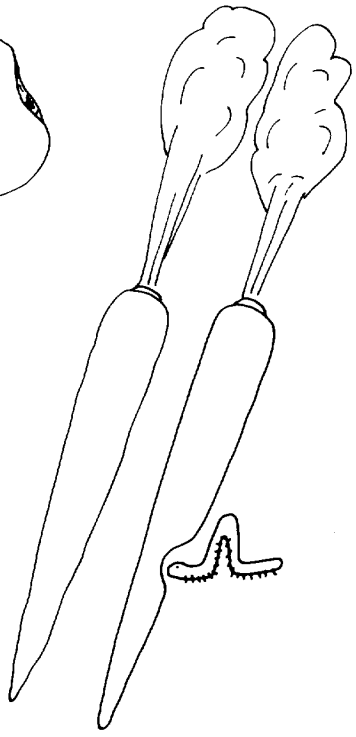


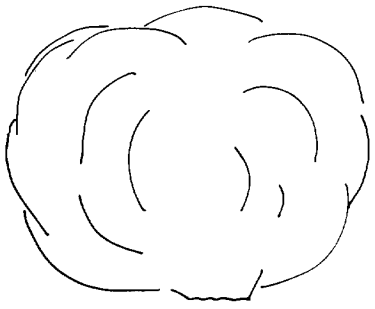


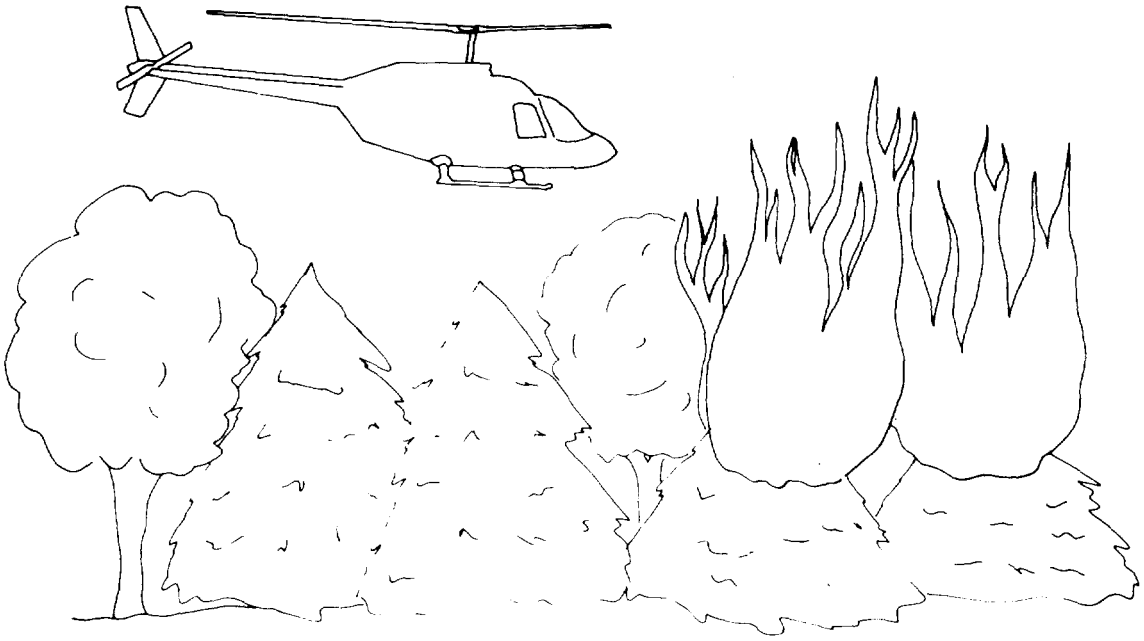


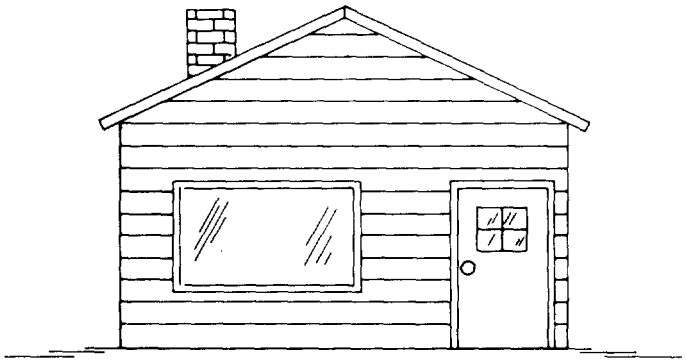


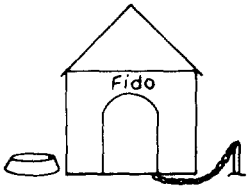


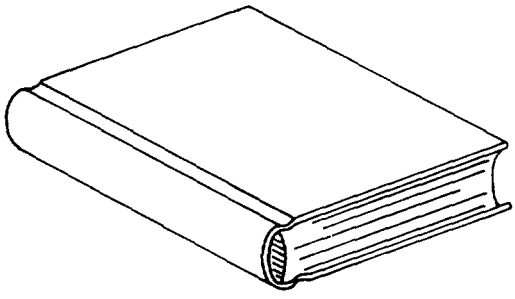


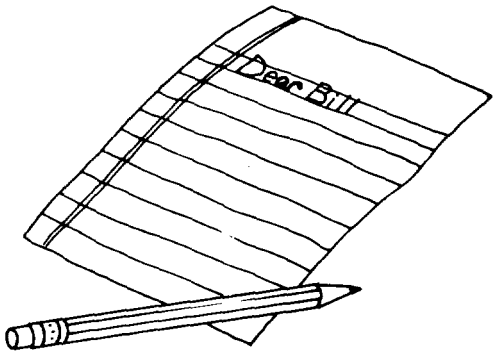


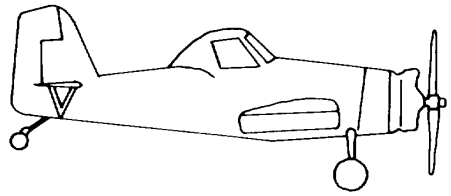





Fido




Dear Bill



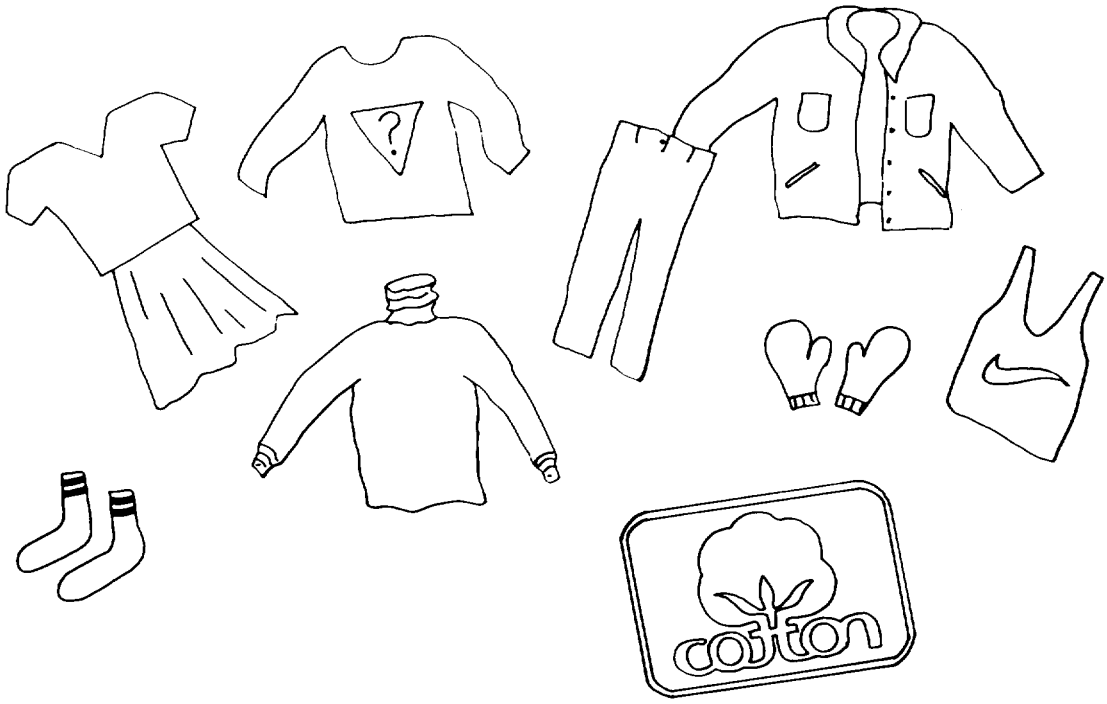
BOLL WEEVIL (LARVA)

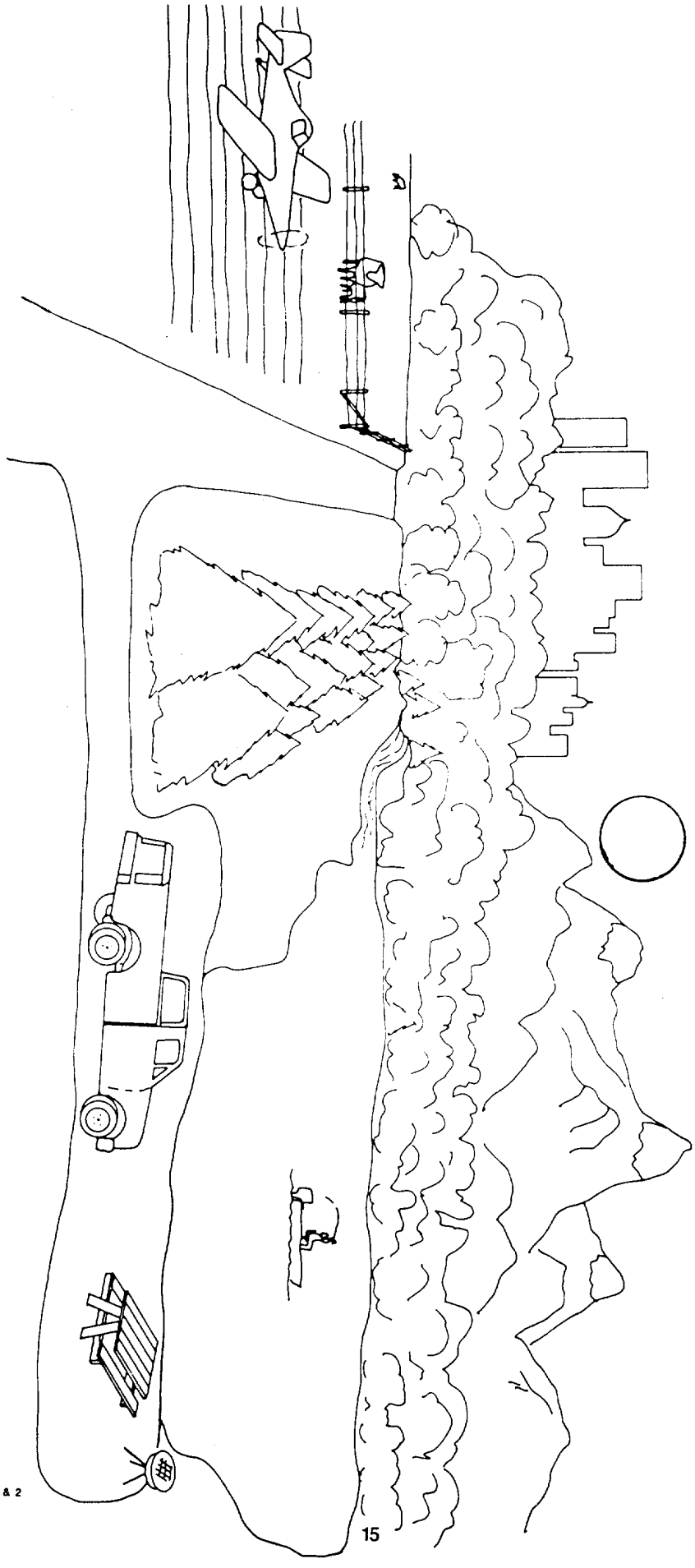
BOLL WEEVIL (ADULT)

COTTON APHID (ADULT FEMALE)

COTTON LEAF PERFORATOR (LARVA)

PLANT BUGS (ADULT)





INTRODUCTION: GRADES 3, 4, and 5

The agricultural aviation industry is presented to grades 3, 4 and 5, by integrating current and accurate information about the industry into the existing curriculum. It is assumed that the students have a basic understanding of the industry. If the students do require basic knowledge about the agricultural aviation industry it is suggested that the section written for the younger grades be presented in an abbreviated form.

The 'agricultural' side of the agricultural aviation industry is drawn upon in this guide since it affects the daily lives of the students. If the students are interested and excited about the aviation aspect of the industry further information may be presented. Sources of materials to enhance both the agricultural aspect and aviation aspect are found in the materials and resources listing.

The information, problems and questions contained in the guide are only suggested ideas. The addition of information to make the concepts presented more easily understood is recommended. Relaying prior knowledge about the industry, and life experiences with agricultural aviation, are beneficial to the students.

The length of time devoted to each subject area and the sequencing are not necessarily dictated by the order of the guide. It would be advantageous to read all the information contained in the guide and become familiar with the goals and objectives prior to integrating the questions or problems into daily lessons.

The instructions for the teacher for each subject area are written in goals and objectives. It is necessary for the teacher to supply the class with the student lesson sheets and the supplemental sheets. The career listing (supplemental sheet no. 6) is a suitable source list from which to obtain an outside speaker.

Before introducing the agricultural aviation industry to the students it is suggested that a pre-test be administered and the scores recorded. After the students have completed a portion of, or all of the activities, the pre-test can be readministered as a post-test.

TEACHER DIRECTIONS FOR GRADES 3, 4 & 5

GEOGRAPHY and COMMUNITY

Goal: To show the students how agricultural aviators utilize geographics information and to provide information about the role agricultural aviators play in the work force.

Objective No. 1: The students will become familiar with legal land descriptions (supplemental sheets no. 3 and no. 4)

1. It may be necessary to supply more problems for the students to understand legal land descriptions.
   a. Utilize legal land descriptions of a nearby rural area. These should be available through the county courthouse.
   b. Contact a cartographer (map maker) or a representative from a company which makes rural directories to speak to the students.

Objective No. 2: The students will learn that climatic conditions influence the type of food or fiber grown in an area and will understand why aerial applicators assist in those areas.

Objective No. 3: The students will become aware of careers which are directly and indirectly related to agriculture. (supplemental sheets no. 2, no. 6 and no. 9; activity sheets no. 2A and no. 2B from grades K, 1 & 2)

1. To provide further information to the students about related careers refer to the resource listings.

HISTORY

Goal: The students will know basic information about the history of the agricultural aviation industry and what role it played In the development of agriculture in the United States and its current role.

Materials: U.S. History book; pictures of 1920's equipment and crop spraying aircraft and people; pictures of present day agricultural aircraft and equipment; encyclopedias.

Objective No. 1: The students will read or listen to "The History of Agricultural Aviation in the United States" and then answer questions about the information. (supplemental sheet no. 1)

Objective No. 2: The students will utilize their U.S. History books and other reference materials to respond to questions about the changes in agriculture and the evolution of agricultural aviation. (supplemental sheet no. 8 and no. 9)

1. Details may need to be provided for the students.
2. The students will need to know the type of graph and may need further assistance.
3. River blindness in Africa is presently being controlled by an insecticide applied aerially. The students may be interested in information about this current event.
4. Contact an agricultural producer from the 1940's or 1950's to speak to the class about the changes in agriculture (from the growing of crops to the selling of the products at the grocery store).

GOVERNMENT

Goal: The students will learn that the aerial application industry is highly regulated.

Objective No. 1: The students will become familiar with the government agencies which regulate the industry by reading the information and then answering the questions.

1. If the students desire to learn more about the regulatory agencies have them write to request information.

HEALTH

Goal: The students will understand the necessity for aerial applicators to be physically fit and follow safety guidelines.

Objective No. 1: The students will answer the health and safety questions about aerial applicators by referring to information previously learned and using information supplied. (supplemental sheets no. 2 and no. 9)
Objective No. 2: The students will become aware of the need for safety while utilizing pesticides by becoming familiar with pesticides used in and around their home.

1. If desired, a more thorough study of household pesticides may be done.
   a. Have the students study the labels and ask questions to insure they understand the vocabulary.
   b. Talk about using the pesticides as directed on the label as protection for themselves, others and the environment.
   c. Address the terms; parts per million, parts per billion, parts per trillion. (refer to Science section)
   d. Have the students check at the grocery store and hardware store for the number and names of some household pesticides.
   e. Present information about the number of accidental poisonings each year from household pesticides.
   f. Present and discuss basic emergency procedures to follow in the event of an accidental poisoning from a household pesticide. Provide the students with the telephone number of the nearest poison control center or hospital.

LANGUAGE

Goal: The students will realize how important good language skills are to an agricultural aviation pilot or the owner of an agricultural aviation business. (supplemental sheets no. 3, no. 4 and no. 5) It would be advantageous if the students had completed the Geography section on 'legal land descriptions'

Objective No. 1: The students will utilize speaking, listening and writing skills in the role of an agricultural aviator.
Objective No. 2: The students will complete the exercises on homonyms.
Objective No. 3: The students will become familiar with vocabulary words used in the agricultural aviation industry.

1. These words may also be incorporated into spelling lessons.
2. Careers which the students are not familiar with could be made into a vocabulary lesson(s). (supplemental sheet no. 6)
3. The students can make crossword puzzles or word searches with these vocabulary words in a computer class or with graph paper.

Answers:

Noun(N) or Verb(V)	l.	N-V	2.	V-N	3.	N-V	4.	V-N
	5.	N-V	6.	N-V	7.	V-N	8.	N-V
Fill in the blank	1. pest - pesticide			2. herb - herbicide				
	3. insect - insecticide			4. hopper - grasshopper				
categorization	l. submarine			2. laundry soap 3. veterinarian 4. milk				
	5. bumper 6. teacher			7. swimsuit 8. cosmetologist				
	9. trees 10. aerobatics							
Sequencing	3 - 2 - 5 - 4 -1							

Objective No. 4: The students will read the play, "Andy the Ag Plane", make the character 'costumes', practice it and then present it. (play on supplemental sheets 43-52)

1. The play is appropriate for younger children and the class may desire to present it to the lower grades.
2. The crop in the play may be changed to what is produced in your area or provide information about the unfamiliar crop to the students.

Teacher directed activities:

The students will utilize skills learned in language class to obtain further information about the agricultural aviation industry.

1. Write to a person in your area who is involved in agricultural aviation and invite them to speak to the class. You can obtain the name of an aerial applicator near you by contacting the National Agricultural Aviation Association (NAAA). (skills - letter writing, penmanship, addressing envelope)
2. If the applicator invited is unable to speak to the class have the class conduct an interview by letter and request photos of the applicator's business.
3. Instruct the students to write a paragraph (dependent upon the ability level) containing information the agricultural aviator supplied in the classroom visit or from the letter interview.
4. Ask the students to explore the career of an agricultural aviator and then write a brief description of the type of person he or she is and what they do. (supplemental sheet no. 2)
5. Have each student give an adjective which they think describes an agricultural aviator. Write each adjective on the board. Ask the students how many of the adjectives are synonyms; antonyms.

MATHEMATICS

Goal: The students will complete the problems supplied in the curriculum guide.

1. Similar problems may be developed for the students to practice their skills.

Note - The problems are arranged by suggested grade level but the problems for prior grades may be presented to the class. The students should be encouraged to attempt all the problems within their ability level.

Suggested Grade 3 - Answers (supplemental sheet no. 7 for problem 4, supplemental sheet no. 3 for problem 5)

1. 11 acres
2a. Sonja b. 3 miles c. 3:30
3a. 7,249 - 9,875 b. Pilot Barb c. weeds take moisture, sunlight and soil nutrients away from the wheat
4a. Thrush, Air Tractor, Ag Cat b. Helicopter c. Piper Brave
d. Choice of each student e. Air Tractor
5a. 640 b. section - draw a square c. square d. square divided into quarters - 1A e. yes
f. square with 4 equal divisions; yes g. 2 h.480 i. $5.39
6a. 3 b. no c. have an accident (crash land), land in a field d. $78.00

Suggested Grade 4 - Answers

1a. 10 5/6 b. 280,000 c. 12,399,423 d.Erv-11, Sue-l2, Ron-14.5, Dennie
13 e. Ron f. Ron g. g. hours h. yes i. spray pilots work long hours because:
growers order work at the same time; need proper weather conditions to spray in - usually do not spray in heavy wind, rain , if rain is forecasted within a certain period of time (because it may effect the performance of the agrichemical), if the temperature is too hot or too cold; so the problem is controlled before the crop is lost; to provide the grower with the best service possible, etc.

2. The bar graph should represent the correct information, be neat and easily read.

3a. 10 bushels b. $40.00 c. 240 acres d. 5 loads
4a. 5,000 acres b. 1/10 gallon c. have to spray 2 times as fast, possibly hire extra pi
lots and aircraft d. the worm may destroy the trees
5a. 80 oz., 100 oz., 400 oz., 800 oz. b. 80/128, 100/128, 3 16/128, 6 32/128 c. 40 pts.,
80 pts., 480 pts. d. 20 qts., 40 qts., 480 qts. - 6 gal., 10 gal., 60 gal.

Suggested Grade 5 - Answers

1a. Stan-$25,160.00 Mike-$20,400.00 Art-$27,360.00
b. Stan-200 acres per hour Mike-150 acres per hour Art-190 acres per hour
c. 85,500 acres d. $72,920.00 e. $95,000.00 f. 5,175 acres
g. 625 gallons of insecticide and 20,000 gallons of water
h. 15,000 acres of corn 4,600 acres of pastureland i. 20,000 acres of corn
2a. 2,250,000 b. food - cereal products, rice, rice cakes, etc
3a. 120 eggs b. 180 eggs c. 1,200 eggs, 2,400 eggs, 12,000 eggs d. 1,800 eggs, 4,800 eggs, 18,000 eggs e. yes f. yes, so the boll weevils do not destroy the crop aerial applicators can assist by economically applying the insecticide without damaging the crop
4a. Have the students look up the size of a grasshopper in an encyclopedia and then measure out on a piece of paper the size in inches. Have the students determine how many grasshoppers need to be measured and cut by each student to get the 100 required. Let the students answer the questions after they have measured off the square yard and placed the grasshoppers in the area.
b. times c. yes d. Aerial applicators can assist the growers by applying insecticides to control the grasshoppers so the crop isn't destroyed by them.

SCIENCE

Goal: The students will gain knowledge about the industry of agricultural aviation by reading the science information and performing the experiments. The worksheets containing the information and science experiments will need to be distributed to the students.

Objective No. 1: The students will know how large an acre is after reading the information and following the instructions.

A tape measure and a large open area will be needed. The students should understand the concept of an acre once they have been able to visualize it. It should also aid in their understanding of 'legal land descriptions', (supplemental sheet no. 3)

Objective No. 2: The students will develop an understanding of the amount of material (seeds, fertilizer, pesticide) that aerial applicators spread over an acre of land.

Water, measuring cup, 5 or more containers holding a gallon each and a borrowed bag of grass seed or lawn fertilizer will be needed in order for the students to understand the information presented. This experiment will need to be done outside of the building in an open area.

Have the students mark out an acre (directions on "What is an acre?") and then attempt to spread out the same amount as aerial applicators do over an acre of land. Although it will be difficult to simulate the 'spray' that an agricultural aircraft produces, the students should be able to understand that the liquid material is 'misted' over an acre of land, not put out as water is from a garden hose.

For the comparison of 'pounds per acre' have the students read the label on the bag of grass seed or lawn fertilizer and, with the teachers assistance, determine how large of an area the grass seed or fertilizer is actually spread over. (Position the students on the four corners of the area which the grass seed or lawn fertilizer will cover.) Although they won't actually spread out the seed or fertilizer they should be able to realize that the dry product is not spread so that is covers the ground, like a covering of snow, but that it is dispersed evenly over the cropland.

Objective No. 3: The students will become familiar with the terms parts per million (ppm), parts per billion (ppb) and parts per trillion (ppt).

These are important concepts since the EPA and other organizations refer to the amount of pesticides or other product residues in these terms. The students should realize that these are only measurable by technical equipment and could not be visually seen by a human being.

Objective No. 4: The students will understand that weather conditions play an important role in the industry of agricultural aviation.

The experiment is written for the students to follow and a materials list is included on the sheet to he handed out to the students. The term 'knots' may need to be explained to the students or they can find a definition for it.

Objective No. 5: The students will understand the necessity of eliminating weeds in a food or fiber crop by completing the experiment involving dandelions. The experiment is written for the students to follow and a materials list is included on the sheet to be handed out to the students.

For enrichment: The students or a student can study insects which harm food and fiber crops. Information about these insects can be obtained through a local extension service, an agricultural college/university, or your State Department of Agriculture can direct you to an appropriate information source.

The students can learn more about aviation and the principles of flight. Many educational programs and materials can be obtained by writing the associations under the heading of 'Aviation' in the materials and resources listing.

COMPUTER CLASS

Suggested lessons: The students can develop word searches and crossword puzzles with vocabulary words (career, words unique to agricultural aviation) if they have the software available to them.

AGRICULTURAL AVIATION

How does agricultural aviation affect you? Check the areas.

_____The movies you see.
_____The food you eat.
_____The friends you make.
_____The time you get up.
_____The streets you travel on.
_____The clothes you wear.
_____The shoes you wear.
_____The paper you use.
_____The house in which you live.
_____The T.V. programs you watch.

How does an aerial applicator locate a field?

Circle Yes or No

Do agricultural aviators assist the cotton growers?	Yes	No
Did agricultural aviation exist in 1901?	Yes	No
Did agricultural aviation exist in 1950?	Yes	No
Doe skin aerial applicator have rules to follow?	Yes	No
Does an aerial applicator need to have good math skills?	Yes	No
Do you have pesticides in your home?	Yes	No
Does an aerial applicator need to be concerned about weather?	Yes	No

Check which careers are related to the growing of food and fiber crops.

_____Nurse
_____Mechanical Engineer
_____Grocer
_____Swimming Pool Cleaner
_____Coal Miner
_____Agricultural Aviator
_____Agri-chemical salesman
_____Dressmaker
_____Highway Engineer
_____Entomologist

AGRICULTURAL AVIATION

How does agricultural aviation affect you? Check the areas.

_____The movies you see.	____✓____The clothes you wear.
____✓____The food you eat.	____✓____The shoes you wear.
_____The friends you make.	____✓____The paper you use.
_____The time you get up.	____✓____The house in which you live.
_____The streets you travel on.	____✓____The T.V. programs you watch.

How does an aerial applicator locate a field?

By using legal land descriptions.

Circle Yes or No

Do agricultural aviators assist the cotton growers?	(Yes)	No
Did agricultural aviation exist in 1901?	Yes	(No)
Did agricultural aviation exist in 1950?	(Yes)	No
Does an aerial applicator have rules to follow?	(Yes)	No
Does an aerial applicator need to have good math skills?	(Yes)	No
Do you have pesticides in your home?	(Yes)	No
Does an aerial applicator need to be concerned about weather?	(Yes)	No

Check which careers are related to the growing of food and fiber crops.

_____Nurse	____✓____Agricultural Aviator (spray crops)
____✓____Mechanical Engineer (design equipment)	____✓____Agri-chemical salesman (sells pesticides)
_____Grocer	_____Dressmaker
_____Swimming Pool Cleaner	_____Highway Engineer
_____Coal Miner	____✓____Entomologist (identifies insects)

Geography and Community

An agricultural aviation pilot has the skill of quickly locating the field or area to be sprayed while flying. Do you wonder how that is accomplished?

In most areas of the United States the pilot uses a 'legal land description' which is a description of a tract of land in legally precise terms. This information or 'legal description' explains the exact location of the tract and the number of acres it contains. To become familiar with 'legal land descriptions' study the information sheets supplied by your teacher.

1. Now that you are familiar with 'legal land descriptions' you may want to refer to your math book for more information on how land is measured (acres, quarter, section, etc.).
2. To practice using 'legal land descriptions' visualize that you are in the office of an agricultural aviation firm located in the NE Quarter of Section 1 in Township l30N Range 48W (Devillo Township). First read the conversation below between the grower and the pilot. Next, using your 'legal land description' map of Devillo Township, locate the field and trace the path the airplane would fly. Finally, be the grower and order a crop of your choice sprayed for a problem of your choice or be the owner/operator of the aerial application firm taking the order and locating the field.

Example:

Grower: (Student 1) - "I would like you to spray 80 acres of wheat to control the grasshoppers. They are destroying the crop."

Pilot: (Student 2) - "Where is the field located?"

Grower: (Student 1) - "The field is in the W1/2 of the NE1/2, Township 130N Range 48W."

3. Is there a 'legal land description' of the property owned by the school district? See if you can find out what it is. Is it worded the same as a 'legal land description' of cropland?
4. Are there any food or fiber product producers located within 5 miles of the school? 10 miles? 20 miles? 100 miles?
   a. What do the food or fiber producers located closest to you produce?
   b. What types of food or fiber products are grown in the region in which you live?
   c. Could the products produced in your region be grown elsewhere? (the mountains, the desert, in colder climates) Why or why not?
   d. Do the producers of food or fiber products in your region need the services of an aerial applicator?
   e. What type of work would an aerial applicator do in your region? (seed, fertilize; control disease, insects, or weeds; desiccate)
   f. Develop a chart, to organize the information gathered, which shows the food and fiber products produced in your region and what services an aerial applicator may provide.
5. Would an aerial applicator do similar work in other regions of the United States? In other countries? Using a map, locate and name those areas.
6. Along with aerial applicators, millions of other people assist the food and fiber producers of this country in growing high quality products and in making

them available to you, the consumer. From the time the decision is made to produce a food fiber crop up to the time it is consumed or used, millions of people are involved.

a. What careers and industries are related to agriculture? (be sure to include the banking, transportation, and grocery industries; and the careers of a chemist, biotechnologist, entomologist, truck driver, aerial applicator, elevator manager, farmer, engineer, banker, clerk, produce manager, and housewife) Ask your teacher for assistance.

b. How many people do you personally know who work directly or indirectly with the production of food and fiber?

c. Research one career related to agriculture that interests you and find in formation about it which includes; career description, education requirements, job location and salary.

HISTORY

Your teacher has an information sheet entitled "The History of Agricultural Aviation in the United States". Read the information sheet and answer the following questions.

1. When did agricultural aviation begin in the United States?

   a. 1943 b. 1912 c. 1921

2. In what state did agricultural aviation have its beginning?

   a. Indiana b. Ohio c. Alaska

3. What was the first crop treated by aerial applicators?

   a. cotton b. tobacco c. rice

4. What were the early aerial applicators called?

   a. civilians b. crop dusters c. air force pilots

5. Were airplanes ever developed specifically for aerial application?

   a. yes •b. no c. maybe

You have already talked about the number of different careers and industries related to agriculture. Hundreds of people are involved in the production of food and fiber from the time the soil is prepared for seeding up until you utilize the final product.

1. Were as many people involved in the production of food and fiber when America gained its independence in 1776? Who was involved at that time?
2. Had it changed by the time of the Civil War in the 1860's? If there were changes what were they?
3. Were there any changes from the Civil War up until the 1920's?
4. Were any of your ancestors directly involved in the growing of food and fiber products? What did they do? Were any crop dusters? (you may need to ask your parents or grandparents for assistance in answering these questions)
5. Why are there so many more people involved in assisting the food and fiber producers now than 40, 50, or 100 years ago?

Read the following information:

In 1988 each American farmer produced enough food and fiber for 114 people.
In 1978 each American farmer produced enough food and fiber for 56 people.
In 1950 each American farmer produced enough food and fiber for 25 people.
In 1910 each American farmer produced enough food and fiber for 7 people.

1. Make a graph showing the above information.

2. With the assistance of your teacher think of reasons why each American farmer feeds more and more people.

3. Does the agricultural aviation industry have anything to do with the increase? Locate pictures of the early crop spraying airplanes and compare them to pictures of automobiles and other equipment of the era (1920's). Notice how the people and pilots dressed. What was happening in the United States at that time? Find pictures of aircraft (helicopters and airplanes) which are presently used for aerial application. Compare them to the automobiles of today.
Would the following events have occurred in history if aerial application and the proper agrichemicals existed?

1. In 1874, Rocky Mountain locusts devastated grain growing areas of the great plains from Texas to Canada.
2. In 1878, 5,000 people died in Memphis, Tennessee, and 4,000 people died in New Orleans, Louisiana, from an epidemic of yellow fever.
3. In the 1930's, grasshoppers destroyed the crops in the great plains regions.
4. In 1846, nearly a million people died in Ireland because a blight destroyed the potato crop, the primary food source. (Great Potato Famine)

GOVERNMENT

As citizens of the United States, the people involved in Agricultural Aviation have regulations or laws to follow. The Pilot of an agricultural aircraft is licensed by the Federal Aviation Administration (F.A.A.) which is part of the Department of Transportation. A commercial pilots license and a certificate to operate an agricultural aircraft are required and obtained through the F.A.A.

In most states the Department of Agriculture is the government agency which monitors the proper and correct usage of pesticides and agrichemicals. All aerial applicators are required to follow the directions on the chemical labels which are approved by the Environmental Protection Agency (E.P.A.). A State Aeronautics Department exists in many states and is responsible for the state licensing of aerial applicators. If special laws concerning aerial application exist at the county or township level, the Ag pilots are required to follow them.

All agricultural aircraft are approved by a branch of the F.A.A., as are all passenger carrying aircraft. This approval is given only if the aircraft meets safety and airworthiness standards. Both fixed-wing airplanes and helicopters are considered aircraft.

An agricultural aviation operation may employ workers and is required to follow the laws of the federal and state Departments of Labor. The standards and regulations of the Occupational Safety and Health Administration are also in effect for the agricultural aviation industry.

1. How many government agencies have laws which affect the agricultural aviation industry? What are they?
2. Which agency deals only with aviation?
3. Write to a facility which trains pilots and ask what the requirements are to become a private pilot; a commercial pilot.
4. Where is the closest Federal Aviation Administration office located? (look in the U.S. Government section of your phone book)
5. Would the Internal Revenue Service have laws which agricultural aviators must follow?

HEALTH

In choosing a career as an Ag pilot a person is choosing a way of life in which he or she must be physically fit, have superb coordination and be safety conscious while spraying and working with pesticides. In order to maintain a commercial license an ag pilot must pass a flight physical every year. (To learn more, refer to the picture of an Ag pilot and the "Profile of an Ag Pilot" your teacher has for you.)

1. What can Ag pilots do to keep themselves physically fit and alert during the spraying season?
2. For what reason must Ag pilots have good vision? good peripheral vision?
3. What do Ag pilots do to protect themselves while loading chemicals or when actually spraying?

In order to stay healthy an Ag pilot should eat foods from the basic four food groups. What are the four basic food groups and list four foods from each group.

1. Which group comes from orchards and truck farms?, from grains?, from dairy cattle?, from animals?, fish?, and nut trees?
2. Would these food sources ever need the services that an aerial applicator provides?
3. In which food group(s) would weeds, plant disease or insects need to be controlled? In which food group(s) might seeding or fertilizing by an aerial applicator be required? In which food group(s) would it be desirable to keep pastures or grazing lands free from weeds and insects?
4. What might happen to the food sources if: the weeds, diseases or insects were not controlled?; seeding or fertilizing was not done?; the cattle did not have good pasture land?
5. Would not having enough food be unhealthy?

Do insects carry diseases which could make humans ill? Research what insects carry human diseases. What can aerial applicators do to assist in the management of diseases carried by insects?

Aerial applicators are concerned about the environment in which they live and work. In order to insure the products they apply do not harm the environment they follow the labeled directions which are approved by the Environmental Protection Agency (E.P.A.). All people should follow the labeled directions of products they use in order to protect themselves and their environment. With the assistance of an adult, read the label or instructions on a household product which is considered a pesticide; insect sprays and repellents, fly strips, flea powders, bathroom cleaners, chlorine tablets for swimming pools, weed and feed for lawns, roach motels, mouse and rat poisons or another pesticide you use in your home.

1. Does the label contain directions on how much of the product to use?
2. Does the label give information about using the product around young children or keeping the product away from young children?
3. Does the label contain information about what to do if a human swallows the product or if the product gets on their skin or in their eyes.
4. Would it be wise to not follow the directions on the label?
5. Would the precautions be similar for using the products safely around your pet?

LANGUAGE

Listening - Speaking - Telephone Skills - Writing

How accurately do you take phone messages? If you operated an agricultural aviation firm you would need to take accurate messages. You must also know the correct questions to ask to obtain adequate information about a spraying job ordered by a grower. Study the work order form supplied by your teacher. Determine what questions you would ask in order to obtain adequate information to spray the correct field with the proper amount of the ordered chemical.

1. Be inventive and make up some names for the agrichemicals (pesticides) which a grower may order. (Remember, insecticides are used to control insects, herbicides are used, ,to control unwanted weeds, fungicides are used to control plant diseases, fertilizers are used to help the plants grow; an example of a product used to control grasshoppers might be "Hopper-rid")
2. Or, obtain names of chemical companies in your area and write for literature and information about pesticides and the labeled rates on various crops.

3. With a partner, take turns being the grower, who calls in a spray order and the aerial applicator, who asks the questions and writes the map.

4. To complete the spray work order choose a name for your agricultural aviation firm and draw some artwork to place on the work order in the upper left-hand corner.

Vocabulary

Is the underlined word in the sentences a noun or a verb? Some of the words are unique to the agricultural aviation industry.

l. We took a taxi to get to the hotel from the airport.
   The Ag plane has to taxi down the runway in order to take-off into the wind.
2. The pilot, Bernie, will spray Grower Miller's field after the wind goes down. Bernie will make sure that the spray will go only on Grower Miller's field.
3. Pilot Ann will fly around the farm when spraying the field, not over it. Grower Johnson intends to farm 1000 acres next year.
4. The aerial applicator will bill the customer after the spraying job is completed.
   The customer will receive the bill in the mail.
5. The Thrush, an agricultural aircraft, will carry a 400 gallon load. Pilot Al will load the Thrush with the proper amount.
6. The prop on an airplane should be in good condition.
   Pilot Jim will have to prop his Cub in order to start it.
7. Sam will flag the field for Pilot Ruth.
   You will see Sam wave a flag to mark each swath for Pilot Ruth.
8. The spray plane is well maintained by an aircraft mechanic.
   The carpenter will plane down the edge of the door so it will close.

Fill in the blanks below with the correct word. (If necessary, ask your teacher for assistance.)

1. A_____is considered something which annoys you. Add the letters "icide" and form the word_____, a general term used to describe items which control a wide range of problems iii food and fiber crops including weeds and insects.

2. An_____is a plant produced for use as a seasoning. Add the letters "icide" and form the word_____, a product used to control weeds in food and fiber crops or in lawns and garden plants.

3. An_____is a small, usually winged invertebrate animal having three

pairs of legs and a three-segmented body. Add the letters "icide" and form the word_____, a product used to control bugs which damage food and fiber crops, forests, and pastures as well as carry diseases harmful to animals and humans.

4. A_____is the part of the aircraft which holds the mixed chemical or dry material to be applied. Add another word for lawn in front of it and form the word ___, the name of an insect which damages crops by eating the leaves.

Categorization

In each set of words determine which word does not belong and circle it. Be sure you can explain why the word does not belong.

1. airplane tractor submarine truck combine
2. insecticide fungicide herbicide fertilizer laundry soap
3. agricultural aviator airline pilot veterinarian flight attendant air traffic controller
4. potatoes corn cotton milk wheat
5. propeller wings hopper bumper cockpit
6. flagger pilot teacher loader bookkeeper
7. helmet seatbelt fire-proof flight suite swimsuit sunglasses
8. entomologist agronomist chemist biologist cosmetologist
9. weeds insects diseases frost trees hail
10. seeding aerobatics fertilizing snow melting fire fighting

Sequencing

Place the following sentences in the correct order.

1. The Ag pilot flew the Ag Cat back to the strip for another load.

2. The Ag Cat was loaded with insecticide, then it was fueled, flags put in and the windshield cleaned.

3. The cotton grower ordered 100 acres to be sprayed with an insecticide to control the boll weevils.

4. The Ag pilot sprayed the cotton field with the flagger marking the swaths.

5. The Ag pilot started the Ag Cat and then taxied out to the runway.

MATHEMATICS

The math skills learned in school are used daily by an agricultural aviation pilot during the spraying season. Addition, subtraction, multiplication and division are necessary to know in order to put the right amount of chemical into a load, to determine the number of acres for a load, to figure a customers bill, to know how much chemical to buy, to figure the wages owed employees, to figure taxes, to balance a checkbook and to do other necessary calculations which are required to operate a successful agricultural aviation business. The following problems will give you some idea of how dependent an agricultural aviator is on their math skills.

Suggested for Grade 3

1. Grower Jim orders seven acres, Grower Jon orders three acres and Grower Ruth orders one acre to be sprayed. How many acres will Pilot Gerry spray?

2. Flagger Sonja has to drive 6 miles west and 5 miles south of the airport to get to Grower Jon's corn field. In his spray plane Pilot Gerry has to fly 8 miles to get to Grower Jon's corn field.
   a. Who has more miles to go?
   b. How many more miles?
   c. It took Flagger Sonja 20 minutes to get to the field. If she left the airport at 3:10 p.m., what time did she arrive at the field?

3. Pilot Rich sprayed seven thousand two hundred forty-nine acres of wheat for broadleaf weeds, and Pilot Barb sprayed nine thousand eight hundred seventy- five acres of wheat for broadleaf weeds.
   a. Write the number of acres sprayed by each pilot in standard form.
   b. Which pilot sprayed almost ten thousand acres?
   c. Why would a wheat producer have the broadleaf weeds sprayed?

4. Look at the drawings of agricultural aircraft currently used in the agricultural aviation industry. Information about each aircraft is printed below the drawings. Review the information then make a chart showing the information.

   From your information chart answer the following questions.
   a. Which aircraft have the same hopper capacity?
   b. Which aircraft doesn't have a wing span?
   c. Which aircraft has the shortest wing span?
   d. Which aircraft would you like to own?
   e. Which aircraft is the most expensive if purchased new?

5. Grower Bill has 160 acres of corn, 160 acres of wheat, 160 acres of sugarbeets and 160 acres of beans. (use 'legal land description' sheet)
   a. How many acres does Grower Bill farm?
   b. What term is given for that amount of acres? Make a diagram of it.
   c. What shape is it? Did you know that each side is a mile long?
   d. Draw each 160 acre field in the section with each field having all sides the same length. Each 160 acres is what fraction of the total?
   e. Are the fields congruent?
   f. Draw another section. Draw in each 160 acre field with 2 sides being the same length as 1 side of the section. Are the fields congruent?

g. Grower Bill hired Pilot Al to spray the pigeon grass in the wheat field. Pilot Al's Thrush can carry enough product to do 30 acres at one time. How many times did Pilot Al have to go out to the field?

h. Grower Bill wanted all the fields but the corn field treated with an insecticide because grasshoppers were eating the plants. How many acres would Pilot Al spray?

i. Grower Bill had to pay $2.14 an acre for the insecticide and $3.25 an acre for Pilot Al to do the spraying. What was the total cost for an acre?

6. Pilot Dawn sprays with a Piper Brave. Her plane uses 20 gallons of gas every hour of flying and has a gas tank which holds 60 gallons of gas.

a. How many hours can Pilot Dawn spray before running out of gas?

b. Would it be wise for Pilot Dawn to spray 2 hours and 40 minutes before putting gas in the tank of the Brave?

c. What might happen if she runs out of fuel?

d. Aviation gas costs $1.30 a gallon. When the Brave is full of gas what is the value of the fuel?

Suggested for Grade 4

1. Lou owns and operates an aerial spraying service in Arkansas. She employs 4 pilots, Erv, Sue, Ron and Dennie, to fly the 4 Thrushes she owns. The spray season starts in February and usually ends in late November.

a. How many months do the pilots fly? What fraction is that of a year?

b. If each pilot sprays 70,000 acres how many total acres are sprayed?

c. During the spray season Lou purchased 12,400,000 pounds of fertilizer to put on the rice fields. Each rice field received three applications of fertilizer. At the end of the spray season she had 577 pounds of fertilizer in the warehouse. How many pounds of fertilizer were applied?

d. Look at the chart below which shows how many hours each pilot worked or sprayed on June 17th.

Pilot	morning (a.m.)	Afternoon (p.m.)	Evening (p.m.)	Total Hours
Erv	5:00-11:00	12:30-3:30	7:00-9:00	
Sue	5:00-11:00	2:30-6:30	7:00-9:00	
Ron	5:00-11:30	1:00-5:00	6:00-10:00	
Dennie	6:30-11:30	1:00-6:30	7:00-9:30	

e. How many total hours did each pilot work? (put in column)

f. Who worked the most hours on June 17th?

g. How long was Ron off after he worked in the morning?

h. Do the pilots at Lou's operation work long hours?

i. Why do you suppose spray pilots have to work long hours?

2. 'Fire bomber' is the term given to an aircraft which is used to control or put out fires. These aircraft are loaded with fire retardant or plain water and assist ground units or work remote areas alone. In the past many World War II military aircraft were converted to 'fire bombers' and could haul large quantities of water. After looking at the information below, make a bar graph showing how many gallons each aircraft can carry.

TBM - 600 gallons	B-17 - 1800 gallons	B-25 - 1000 gallons
DC-6 - 3000 gallons	DC-4 - 4000 gallons	Fairchild C-119 - 2400 gallons

3. A field of wheat sprayed with a fungicide by Pilot Bob yielded 70 bushels per acre. A field in the same section was not sprayed with the fungicide and yielded 60 bushels per acre.

a. What was the yield difference?

b. The wheat sold for $4.00 a bushel. What was the value of the difference in the yields?

c. When pilot Bob sprayed the field with his Ag Cat he took out four loads of 60 acres each. How many acres were in the field of wheat?

d. If the field sprayed was 300 acres how many loads would Pilot Bob have to take out?

4. Ten thousand acres of forest in Maine needed to be treated with an insecticide because spruce bud worms were destroying the trees. Pilots Jim and John have 4 days in which to get the spraying done and 1,000 gallons of chemical to put on the 10,000 acres.

a. Pilots Jim and John sprayed an equal number of acres. How many acres did each of them spray?

b. How much chemical would be put on each acre of forest?

c. If the wind blew for two days what would happen to their plans?

d. What might happen to the forest if they were unable to spray at all?

5. Ag sprayers are required to follow the labeled directions of all products used. These directions are written on a label attached to the pesticide containers and have the approval of the Environmental Protection Agency.

a. A fungicide is labeled to be applied at 4 ounces to the acre. How many ounces of chemical would go on 20 acres? 50 acres? 100 acres? 200 acres?

b. How many gallons would each of the above amounts be.

c. On a small grain field a herbicide is labeled at the rate of 1 pint per acre. How many pints would be needed to do 40 acres? 80 acres? 480 acres?

d. Convert the pints to quarts? Convert the quarts to gallons.

Suggested for Grade 5

1. Top Hat Aerial Applicators at Benkelman, Nebraska, has three airpl anes and three pilots, Stan, Mike and Art. Study the chart below.

Pilot	Acres	Recorded Hours on Airplane	Rate of Pay	Total Pay
Stan	29,600	148	$.85/acre	
Mike	25,500	170	$.80/acre	
Art	30,400	160	$.90/acre	

a. With the assistance of your teacher, figure the total pay for each pilot.

b. How many acres per hour did each pilot spray?

c. What was the total number of acres sprayed by the pilots?

d. How much did Top Hat Aerial pay out in salary to the pilots?

e. Top Hat Aerial purchased a new airplane for $135,000.00. They were able to sell their older airplane for $40,000.00. What was the difference in the amount received for the airplane they sold and the new plane purchased?

f. Pilot Mike sprayed 15,200 acres of corn for corn borer and 5,125 acres of wheat for weeds, how many acres of range land did he spray for weeds?

g. Pilot Stan sprayed 10,000 acres of wheat with an insecticide to control aphids. He applied the insecticide at the rate of ~ pint per acre in 2 gallons of water per acre. How many gallons of insecticide were used and how many gallons of water were used to spray the wheat?

h. Pilot Stan sprayed 1- times more corn than wheat. How many acres of corn did he spray. The other acres were pasture land. How many acres of pastureland did he spray?

i. Pilot Art sprayed 5,000 acres of wheat. He sprayed 4 times as many acres of corn. How much corn did Pilot Art spray?

2. 2.25 million acres of rice are seeded each year in the United States by agricultural aircraft. (This amounts to 90% of the rice grown.)

a. Write the number of acres in standard form.
b. What is the rice used for?

3. The boll weevil is an insect which lays its eggs in cotton plants. The hatching larvae feed within the boll of the cotton plant and destroy the boll so it doesn't mature, therefore the plant doesn't produce. There are about five generations of boll weevils each year. A female boll weevil lays 10 to 12 eggs a day for 12 to 15 days. The eggs hatch in 3 to 5 days.

a. What is the fewest number of eggs a female boll weevil lays?
b. What is the largest number of eggs a female boll weevil could lay?
c. What would be the fewest number of eggs 10 female boll weevils could lay? 20 female boll weevils? 100 female boll weevils?
d. What would be the largest number of eggs 10 female boll weevils could lay? 20 female boll weevils? 100 female boll weevils?
e. When there are thousands of female boll weevils laying eggs do many cotton-plants become damaged?
f. Is it wise for the cotton producers to control the boll weevils in their cotton fields? Why? Can the aerial applicators assist?

4. Grasshoppers were a problem during the 1988 and 1989 growing seasons in the Red River Valley. Infestations of over 100 grasshoppers per square yard of cropland were reported. They damaged the plants by eating the leaves and the fruit of the mature plants (kernels in the heads of grain, pods on beans). The feeding rate of grasshoppers doubled with a 10 degree temperature change. Thus from 700F to 800F the rate doubled from 700F to 900F the rate roughly quadrupled.

a. How big is a square yard? Measure off a square yard in your classroom. Place 100 paper grasshoppers in it. Does it seem like a lot of grasshoppers? Do you think that the grasshoppers could damage a large number of the plants growing in that square yard.
b. What does 'quadrupled' mean?
c. Would it be wise for growers to control grasshoppers in their crops?
d. How can aerial applicators assist the growers in controlling grasshoppers?

SCIENCE

Area - Volume - Quantity

Area:

Do you know what an acre is? The size of cropland is usually described in the term 'acre'. It is a standard measurement and useful for; buying and selling land, describing a tract (piece) of land; and in knowing how much fertilizer or other product to load in an agricultural aircraft to cover the acreage ordered to be sprayed.

An acre is a measure of land totaling 43,500 square feet. If four of your classmates were positioned to represent the four corners of a square, and stood 208 feet, 8~ inches away from each other, the space they enclosed would be a square acre. In order to do this you will probably need to go outdoors. Be sure to take a tape measure with you.

Do you think a football field is more than an acre or less than an acre? Have your teacher assist you in determining if the football field is more than an acre, less than an acre or about the same size as an acre.

Volume:

When an aerial applicator sprays cropland does the ground get all wet, like it does after an inch of rain, or does the ground stay dry? The amount of liquid material (water and chemical) that an aerial applicator spreads over an acre of ground may vary from 4 ounces per acre up to 10 gallons per acre. The amount depends on the pesticide used and if it is mixed with any water before it is put on the crop land.

To answer the question you will need the following; water, a measuring cup, five or more gallon containers, and an acre of ground (you already know how to measure off an acre of ground from the previous science problem).

1. An aerial applicator is to put out 4 ounces of chemical per 1 acre of land. Is that like a heavy rainfall or like a mist? Measure out 4 ounces of water in the measuring cup. Try to spread it over the acre of ground that you have marked off. Is it actually possible for you to do? Do you think the ground gets wet when an aerial applicator sprays 4 ounces over I acre of ground? If you are able to find an aerosol can of spray paint or hair spray that holds 4 ounces of material (do not spray it out though) you can get a better idea of the small amount that is actually sprayed over I acre of cropland. The way an aerosol can sprays out the product (paint, hair spray) is very similar to the way an agricultural aircraft sprays out a pesticide over the cropland. What happens is that the pesticide is forced through several small openings (called nozzles) which break the pesticide up into small droplets.

2. An aerial applicator is to put out 5 gallons of material (pesticide and water) on 1 acre of land. Is that like a heavy rainfall or more like a mist? Fill 5 of the gallon containers and attempt to spread or spray it over the I acre of land you have marked off. Again it is hard to spray it out like an airplane does but you should see that the ground really does not get wet unless you put all 5 gallons in one spot.

3. An aerial applicator is to put out 10 gallons of material (pesticide and water) on 1 acre of land. Is that like a heavy rainfall or more like mist? Follow the same procedure as you did in no. 2 but refill the five one gallon containers in order to get the 10 gallon amount.

4. A fire bomber is going to drop over 2,000 gallons of water and fire retardant on a forest fire. Is the ground going to get wet?

Aerial applicators are also hired to spread dry products (rice seed, fertilizer) over cropland. This is done by attaching a piece of equipment called a spreader to the agricultural aircraft. Do you think the dry products actually cover up the ground like an inch or two of snow does or is it more like getting a few hailstones? Hint: the ground coverage would be similar to you throwing a handful of sand up in the air and letting it fall to the ground.

1. Your teacher has a borrowed bag of grass seed or lawn fertilizer and will give you directions to follow.

2. An aerial applicator is hired to spread 250 pounds of rice seed over an acre of cropland. Is the ground coverage from the rice seed similar; to one or two inches of snow on the ground or to you throwing a handful of sand up in the air and letting it fall to the ground?

Quantity

Have you ever heard of the term parts per million, parts per billion or parts per trillion? You probably recognize the words million, billion, and trillion.

1. With your teachers assistance write the number l million on a piece of paper. How many zeros does it have? Is it a large number? What would you like to have a million of? Why?

2. With your teachers assistance write the number 1 billion on your paper. How many zeros does it have? Is it a large number? Is it larger than 1 million? What would you like to have a billion of? Why? Are you sure you would have enough room to have a billion of anything.?

3. With your teachers assistance write the number 1 trillion on your paper. How many zeros does it have. Is it a large number? Is it larger than 1 million? Is it larger than 1 billion?

When we are talking about parts per million, parts per billion or parts per trillion we are comparing the number 1 to a million, billion or trillion. The following examples show how tiny or minute a part per million, billion or trillion actually is.

1. One ppm (part per million) is 1 inch in 16 miles. Think of a place 16 miles away. Only 1 inch of the distance of 16 miles is 1 part per million.

2. One part per million (ppm) is: 1 kernel of rice in 36 pounds of rice; 1 minute in 2 years; 1 cent in $10,000.00; I ounce of salt in 31 tons of potato chips; or 1 bad apple in 2,000 barrels. How would you like to search for that 1 bad apple in 2,000 barrels? It would probably take an awful long time. One ppm (part per million) would be like looking for 1 certain person in a city with a population of 1 million.

3. One ppb (part per billion) is 1 inch in 16,000 miles. You would not even get to take a full step on your journey of 16,000 miles and you would be beyond the 1 part per billion (ppb).

4. One part per billion (ppb) is: one second in 32 years; 1 bad apple in 2 million barrels; or 1 teaspoon of sugar dissolved in 1.3 million gallons of coffee - nearly as much liquid that would be required to fill two regulation Olympic-sized swimming pools. Would you even be able to taste the sugar?

5. 1 ppt (part per trillion) is a very, very small amount. It is the weight of 1 flea on 360,000 elephants. Do you realize how much 1 elephant weighs? Where can you find that information, and how much does one elephant weigh? How much does a flea weigh? Would you weigh more if you had a flea on you? So, the weight of one flea on 360,000 elephants is really not very much. In fact, it would be awfully hard to measure with a scale.

Scientists are able to measure 1 ppm, ppb, or ppt, with special equipment. You would not be able to see, smell or taste that tiny amount but it is of concern to people, such as aerial applicators, who apply pesticides. They are very careful and use pesticides as the label directs them so they do not harm the environment or any living being in the environment. Aerial applicators are also very careful while mixing and loading pesticides.

SCIENCE

Weather - Recording Weather Information

Have you noticed that the wind direction or speed may change during the day? Have you noticed that the outside temperature may change a few degrees during the day? Are slight changes in the weather important to you? Your job, as a student, is probably not depend ant on weather. Aerial applicators are dependent on the weather and changes in the wind and temperature affect their working day. Wind and temperature have an affect on the way an airplane flies and where the material being applied will land. In order to do a good job when applying materials, agricultural aviation pilots must be aware of the weather conditions They are unable to control the weather so they learn what to expect when certain weather conditions exist. If the weather conditions are not right for spraying an Ag pilot has to wait until they are.

The following experiment will help you realize that: weather conditions often change during the day; weather is an important, uncontrollable factor in the production of food and fiber; and weather causes stress for agricultural aviation pilots.

Materials needed: Outdoor thermometer, wind speed indicator made from the following - protractor, ruler, clear tape, 25 cm of red thread, Ping-Pong ball.

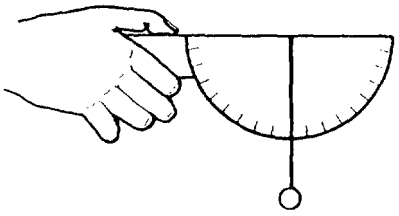
Procedure:

1. Set up the thermometer in a place where it is easy to monitor the reading several times a day. Try not to place it in the direct sunlight.

2. Construct the wind speed indicator as shown in the illustration. Tape the pro- tractor to the ruler. Tape one end of the thread to the ball, and the other end of the thread to the center of the protractor. When held parallel to the ground, the thread should indicate a reading of 90.

3. Take the wind speed indicator outside. Hold it still and level, using the ruler as a handle. Point the indicator into the wind. When the wind blows the ball it will move the thread on the protractor giving you a reading which can be converted to wind speed using the chart below. The number on the protractor corresponds with the speed in knots shown directly below.

Number on Protractor												
90	95	100	105	110	115	120	125	130	135	140	145	
KnotsKnots												
0	5	7	8.6	10	11.3	13	14	15.7	16.7	18.4	20	



4. Record your speed and temperature observations three times a day for one week and then with your teachers assistance make a graph showing the variations (changes). You may also want to record the wind direction each time.

Answer the following:

1. What was the highest wind speed measured during the week?
2. What were the highest and lowest temperatures?
3. An Ag Pilot had a field to spray where the wind had to be blowing from the northeast at a speed between 2 and 8 knots and the temperature needed to between 600F and 800F. Would the pilot have been able to complete the job?
4. How could the weather conditions cause stress for an Ag pilot?

WEED COMPETITION

Weeds are everywhere; in gardens, between the cracks in sidewalks, in parks, along the sides of buildings, in pastures; in flower beds, and in fields. Weeds are w here people do not want them to grow but they seem to appear, even after being pulled up or treated with a herbicide. Weeds seeds are not planted but are spread by wind, water, animals and vehicles. Weeds are able to grow in various climates and some grow almost anywhere.

Why don't we like weeds? The food and fiber growers do not want weeds in their fields because the weeds take water, sunlight, soil nutrients and space away from the crop. The crop suffers because of the weeds, and not as much is produced. Another reason we do not like weeds is that they are not attractive growing through as cracks in the sidewalks, in parks or in flower beds. Most people prefer to keep their property free of weeds.

Dandelions are an example of a weed which grows all over the United States. They are hardy plants that bloom from early spring to late fall and have long taproots so a lack of moisture does not cause them to die. The dandelions are a nuisance and many herbicides are used to keep them from growing in lawns.

The experiment below is set up for you to learn the following: different types of seeds germinate at different times; dandelions are very adaptable; and yield losses occur in crops because of weeds.

Materials needed: 3 clear plastic cups, masking tape, 4 corn seeds, dandelion seeds, potting soil, water, plastic wrap, 3 rubber bands.

Procedure:

1. Write your name, seed type and the date on pieces of masking tape and place them on the outside of each plastic cup.
2. Put 2 to 3 inches of soil in a cup, place 2 corn seeds next to the side of the cup, and cover with ~" of soil. Repeat this process with only dandelion seeds in the second cup and both corn and dandelion seeds in the third cup. Make sure you can see the seeds up against the sides of the plastic cups.
3. Add water until the soil is moist.
4. Cover the top of the cup with plastic wrap. Use a rubber band to hold the plastic wrap in place. (Some students should place their cups near a window and some students should place their cups in a dark, cool area.)
5. Make sure soil is kept moist during the experiment, if necessary add water to the seeds/plants. Do not allow the soil to become too dry. After the plants have sprouted a few leaves above the soil surface, the plastic wrap can be removed.
6. Record your observations each day. Make a graph showing the differences in the germination speed of the two types of plants.

Answer the following questions:

1. Did one type of seed germinate before the other type?
2. How many-days difference was there?
3. Does it matter if the cups were placed in the dark, cool area instead of near a window? Did the weeds grow better than the corn in the dark, cool conditions?
4. Do you think food and fiber producers should try to control the weeds in their fields? Why?

Agricultural aviators are often hired by food and fiber producers to assist with weed control in their fields. A herbicide to control the weeds, which take water, sunlight, soil nutrients and space away from the planted crop, is often applied by an agricultural aviator.

A SHORT HISTORY OF AGRICULTURAL AVIATION IN THE U.S.

Shortly after the turn of the century, American farmers began to seriously consider the use of agricultural chemicals as a means with which to control insects, weeds and plant diseases. Although there were available chemicals that could control some of these problems, there was really no suitable way to apply them to the crops. In 1921, the Ohio Department of Agriculture fitted an airplane with a metal container and filled it with a powdered insecticide. Two U.S. Army pilots applied the chemical to trees that were being destroyed by moths. The experiment was so successful that the government moved airplanes and agricultural scientists to the southern states, where cotton farmers were combating cotton boll weevils. In time, the epidemic was brought under control and America's most important fiber crop, cotton, was secure. Government programs continued to use airplanes to fight insect pests that were causing damage and destruction to America's forests.

During these early years, the aircraft were all modified military or civilian airplanes; the product dispersal systems were homemade. Although the work was exciting, it also proved dangerous to those who flew the early "crop-dusters" as both the men and their planes came to be called. The development of an airplane designed specifically for aerial application occurred in the 1950's. These Ag-planes gradually began to replace the converted aircraft of the previous three decades. At times there have been as many as twelve manufacturers of various types of Ag airplanes. Helicopters eventually joined the ranks of Ag aircraft, and are sometimes the best tool for the job.

Agricultural chemicals have also kept pace with advancements in technology, and have been influential in the growth of the agricultural aviation industry. In the 1930's aerial applicators arrived in the northern states to war against insect and disease pests which threatened fruit and vegetable crops. After World War II, the industry expanded into the western states where the development of new chemicals made possible the control of weeds and insects in cereal grain crops. Some of these new chemicals proved very useful in controlling various insects that carried diseases dangerous to humans. Countries that previously had no control over malaria and river blindness were provided with chemicals which helped save hundreds of thousands of lives and reduced the suffering of millions. All during the 1950's, crop production continued to rise and disease declined as a result of chemical controls.

In 1967, the National Agricultural Aviation Association was formed to help promote aerial application, and to provide a legislative voice. Individual states also formed agricultural aviation associations. These organizations work closely with government agencies, agrichemical companies, aircraft manufacturers and other support industries. Their combined efforts insure that our nation's food, fiber, and forest products can meet the needs of both our own domestic consumption and that of our export markets.

PROFILE OF AN AGRICULTURAL AVIATION PILOT

Who could be an agricultural aviation pilot?

Anyone could be an Ag pilot. They just need to love flying and enjoy working in agriculture.

First a person needs the proper license, called a commercial pilot license, before beginning training to become an agricultural aviation pilot. There are a small number of schools in the United States which offer courses and flight training for the career of an agricultural aviator. Many Ag pilots train from the ground up. They start by loading agricultural aircraft, flagging fields and then gradually gain flight experience while working for an agricultural aviation firm.

An Ag pilot usually enjoys working in agriculture. They know all about the crops they fly over and how to assist the growers with problems such as weeds, insects and plant diseases.

An agricultural aviation pilot also needs to; have quick reflexes, be in good health, know how to operate a successful business, be knowledgeable about weather and know how to maintain his aircraft. These qualities, coupled with a good personality, spell success for an aerial applicator.

The average Ag pilot of today is 38 years old, with 12 years of experience and has flown for over 5,000 hours. Most Ag pilots are like other people, they have families, homes, friends and pets.

What do Ag pilots do?

Ag pilots provide a service for the producers of fruits, vegetables, grains, livestock, lumber, cotton, peanuts, Christmas trees, dairy products and other foods and fibers. They help control pests (insects, weeds, diseases) on the land; seed and fertilize crops; and desiccate or defoliate. They assist the growers in economically producing quality food and fiber for the people of the world. Actually an Ag pilot would fit in the same career category as a house painter, contractor, airline pilot, waitress or plumber.

To do the best job possible, agricultural aviators must know how to apply the agrichemicals properly. They often learn this information while attending educational seminars to keep their licenses current.

An agricultural aviator uses an agricultural aircraft (helicopter or airplane) to apply the product ordered by the food or fiber producer. The manufacturers build these aircraft to withstand thousands of take offs, turns and landings in a spraying season. Designed with the safety of the pilot in mind, the cockpit areas usually remain intact in the event of an accident. Most agricultural aircraft undergo detailed annual inspections by aviation mechanics. For these reasons, few accidents occur in the agricultural aviation industry due to mechanical or design problems. In fact, the industry has a remarkable safety record.

When do Ag pilots spray?

Ag pilots spray on a seasonal basis. The food and fiber producers need their assistance prior to planting and through harvest. In the Northern United States Ag pilots usually work from late April through September (or when it freezes). In the Southern United States, because of the longer growing season, they often work ten or eleven months out of the year.

Agricultural aviation pilots can not always depend on having work. The weather determines their work load. A drought usually means very little work; a wet year usually means more work.

Where do Ag pilots work?

Agricultural aviation pilots work where the food and fiber products are grown. This is usually in the rural areas of the United States.

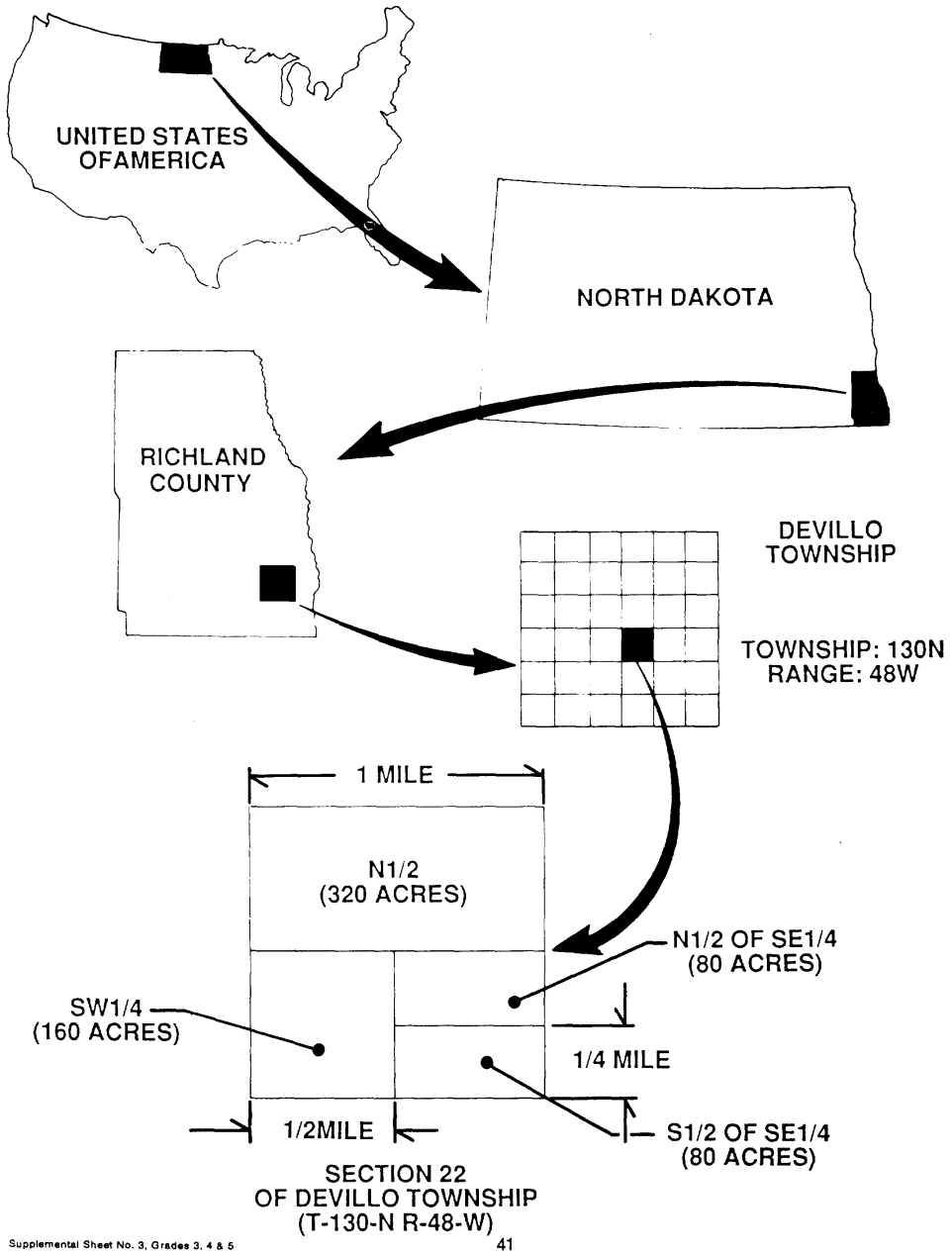
Many pilots are town or city dwellers. They must commute to their job or move to the area where they work during the spraying season.

Many Ag pilots who spray only part of the year have other jobs or careers during the off-season. Sometimes the job is aviation related such as being a charter pilot or an aviation mechanic.

Why do Ag pilots choose that career?

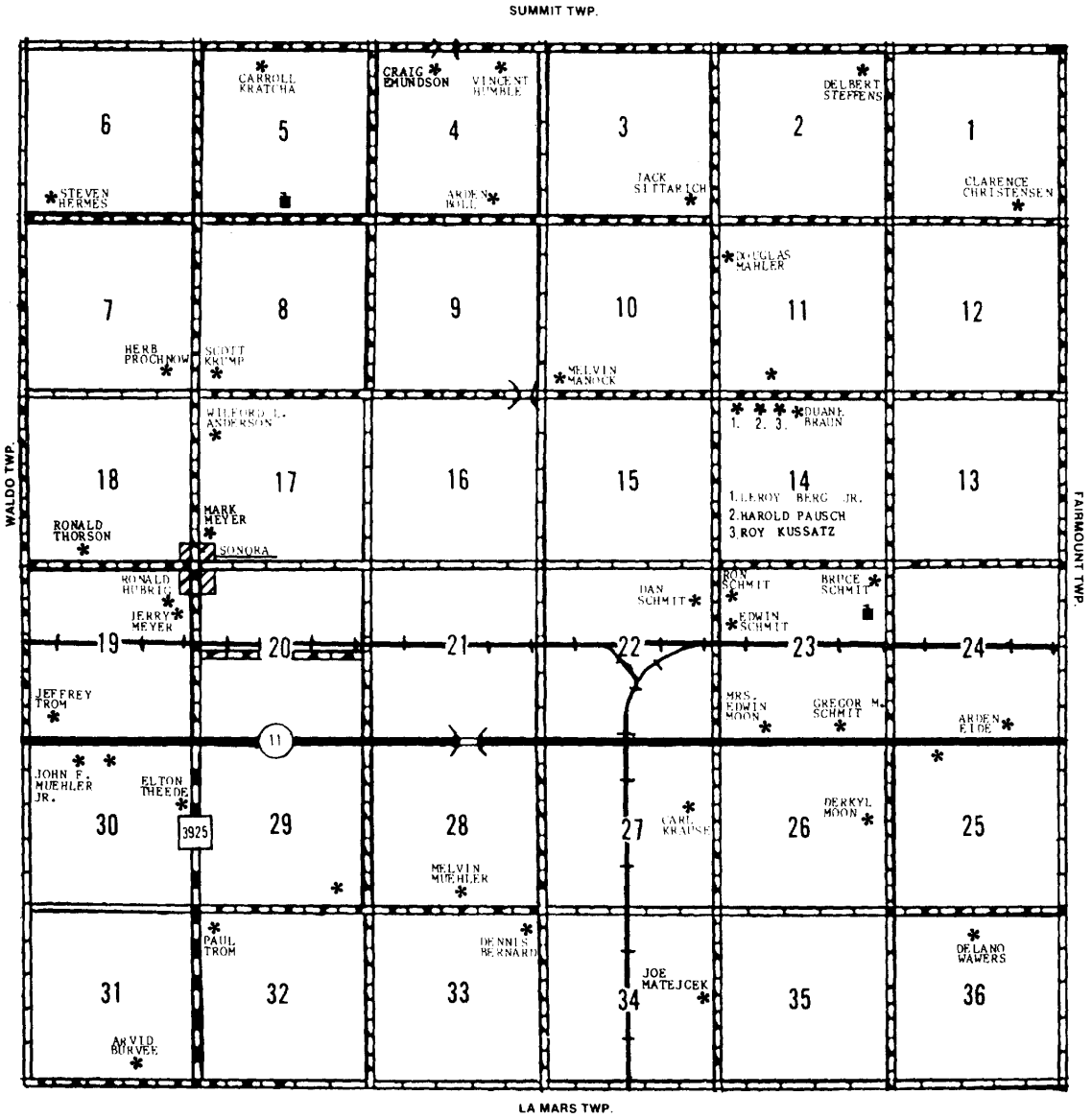
There are hundreds of reasons why pilots choose a career in agricultural aviation. It is a somewhat unique career, there are only 2200 agricultural aviation operations in the United States and approximately 7,000 Ag pilots. Even though there are so few who choose a career as an Ag pilot, they provide an important service to the continued production of food and fiber. There is a great satisfaction in being involved in American agriculture.

LEGAL LAND DESCRIPTIONS



Supplemental Sheet No. 3, Grades 3, 4 & 5 41

T-130-N DE VILLO DIRECTORY R-48-W



Supplemental Sheet No. 4, Grades 3, 4 & 5

RICHLAND CO., ND

Customer _____
_____
_____
_____

Date Ordered _____ Telephone _____ Account No. _____

Crop _____ Treatment For _____

Chemical_____/_____Rate_____/_____

Gallonages: □ 5 gpa □ 2 gpa □ Other _____Stage of Development_____

Date Completed _____ Wind Direction _____ Temperature _____ °F

Time _____ A.M. P.M. Velocity _____ Rel. Humidity _____ %

Pilot _____ A/C _____ Flagman

County _____ Section _____

Township _____ Quarter _____

SPECIAL NOTE

CLEAN-UP

Wind _____

Date _____

Pilot _____ Acres ____

STATEMENT

Date ____/____/____

Cost Per Acre $ _____

X Total Acres _____

TOTAL $ _____

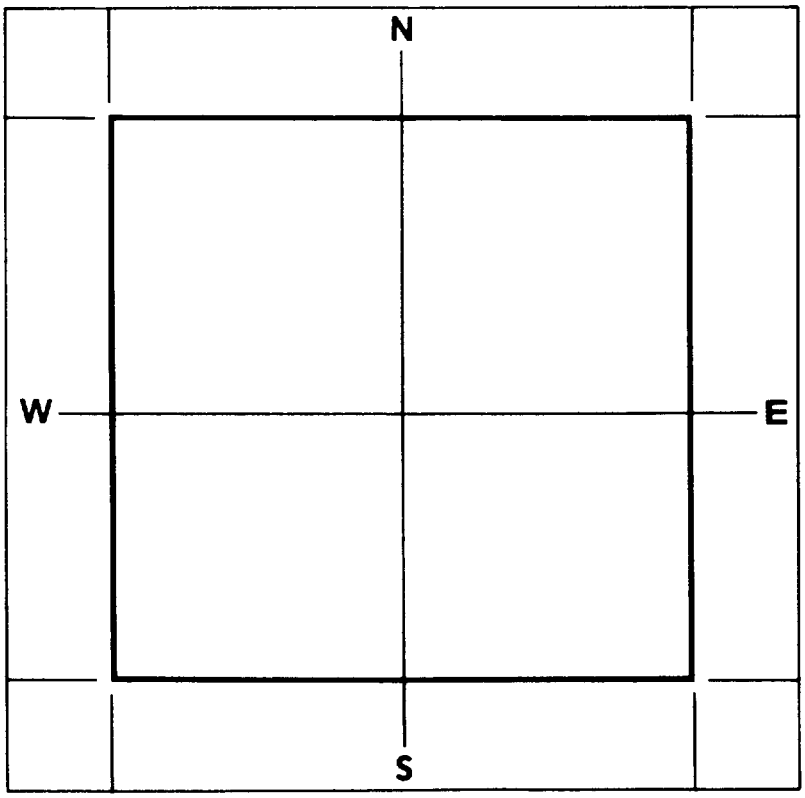
_____ Share $ _____

Deduct $ _____

If Paid By ____/____/____

4100-011-002 _____

4100-012-002 _____



Accounts not paid in full in 30 days from the date of the statement are subject to a service charge of 1½% per month of 18% per annum.

CAREERS RELATED TO AGRICULTURE

The following headings relate to the sequence of events from developing seed to the sale of the processed product. The careers listed beneath each heading relate to agriculture. You can add careers to each heading to make each area more complete.

1. DEVELOPING SEEDS
Researcher to develop seed varieties
Commercial Artist to develop adds
Salesman to sell seeds to growers
Driver to transport seeds
Office Personnel

2. PLANTING/FERTILIZING
Mechanical Engineer to design machinery
Draftsman to develop plans
Machinists/Welders to build machinery
Salesman to sell machinery
Worker to operate planting machinery or
Ag Pilot hired to seed/fertilizer

3. MONITORING WEATHER
Meteorologist to predict weather
Weather Announcer (T.V., radio)

4. MONITORING PLANT DEVELOPMENT
Plant Pathologist to diagnose disease
Agronomist to assist with planning
Chemist (see related industry)
Ag Pilot to spray fungicide

5. CONTROLLING PROBLEM WEEDS
Weed Control Specialist
Chemist (see related industry)
Ag Pilot to spray herbicide

6. CONTROLLING PROBLEM INSECTS
Entomologist to study insects
Chemist (see related industry)
Ag Pilot to spray insecticide

7. HARVESTING FOOD OR FIBER CROPS
Mechanical Engineer/Draftsman
welder/Machinist/Salesman
Farm Worker to operate machinery
Ag Pilot to desiccate/defoliate

8. STORING FOOD OR FIBER CROPS
Architect & Engineer to design elevator
Construction Worker/Welder to build it
Manager to operate elevator
Workers to handle stored crops

9. TRANSPORTING CROPS
Ship Captain/Sailors
Transport Pilot/Crew
Truck Driver/Loading Dock Workers
Train Engineer/Crew Members

10. PROCESSING FOOD OR FIBER CROPS
Architect/Engineer/Workers/Welders
Researchers to develop products
Manager to direct processing
Quality Control Person
Supervisor/Workers to make product

11. DISTRIBUTING PRODUCTS
Grocery Store Manager
Employees to stock shelves
Checkers
Meatcutters/Produce Manager
Cleaning Personnel

Advertising Specialist
Consumer Marketing Specialist
Packaging Engineers

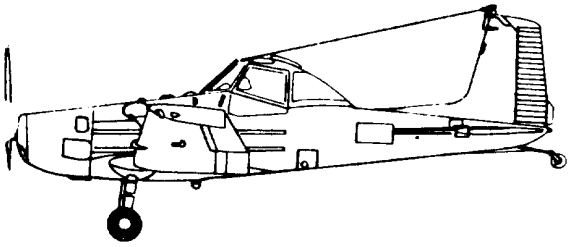
OTHER
Banker/Cartographer/Veterinarian
Computer Software Developer/etc.

RELATED INDUSTRIES AND CAREERS IN THOSE INDUSTRIES:

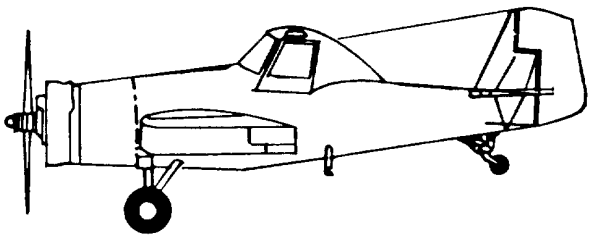
AGRICULTURAL AVIATION
MANUFACTURING
Aeronautical Engineer
Aircraft Manufacturer
Test Pilot
Commercial Ag Pilot
Aircraft Mechanic
Ramp Worker to load aircraft
Flagger to mark fields
Bookkeeper/Secretary

AGRICULTURAL CHEMICAL

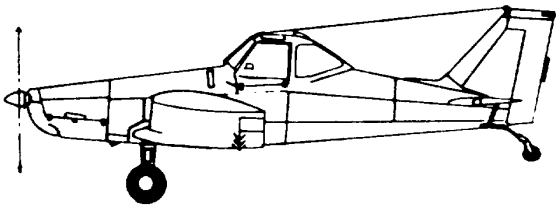
Chemist to develop pesticide
Lab Researcher to assist chemist
Office Personnel
Test Plot Manager to test new product
Biochemist/Toxicologist
Product Manager
Advertising Specialist/Artist
Plant Workers to make product
Packaging Engineers



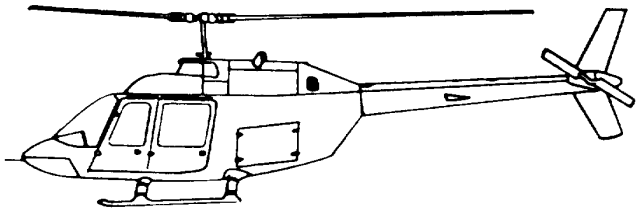
AG HUSKY
1. HOPPER CAPACITY - 280 GALS.
2. WING SPAN - 41.7 FT.
3. COST (NEW) $115,000
   LAST BUILT 1983



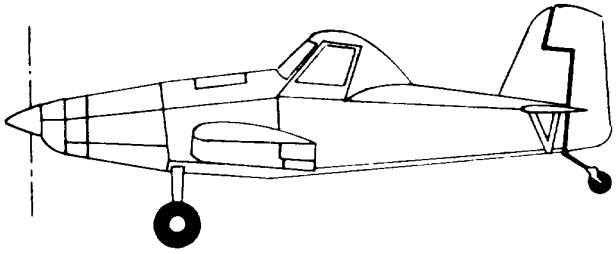
SR2 THRUSH (W/RADIAL ENGINE)
1. HOPPER CAPACITY - 400 GALS.
2. WING SPAN - 44.4 FT.
3. COST (NEW) - $153,000
   CURRENTLY IN PRODUCTION



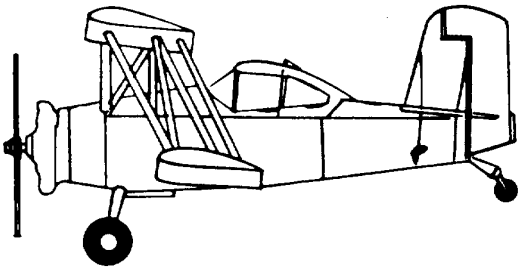
PIPER NEW BRAVE 375
1. HOPPER CAPACITY - 275 GALS.
2. WING SPAN - 38.8 FT.
3. COST (NEW) $119,500
   LAST BUILT 1983



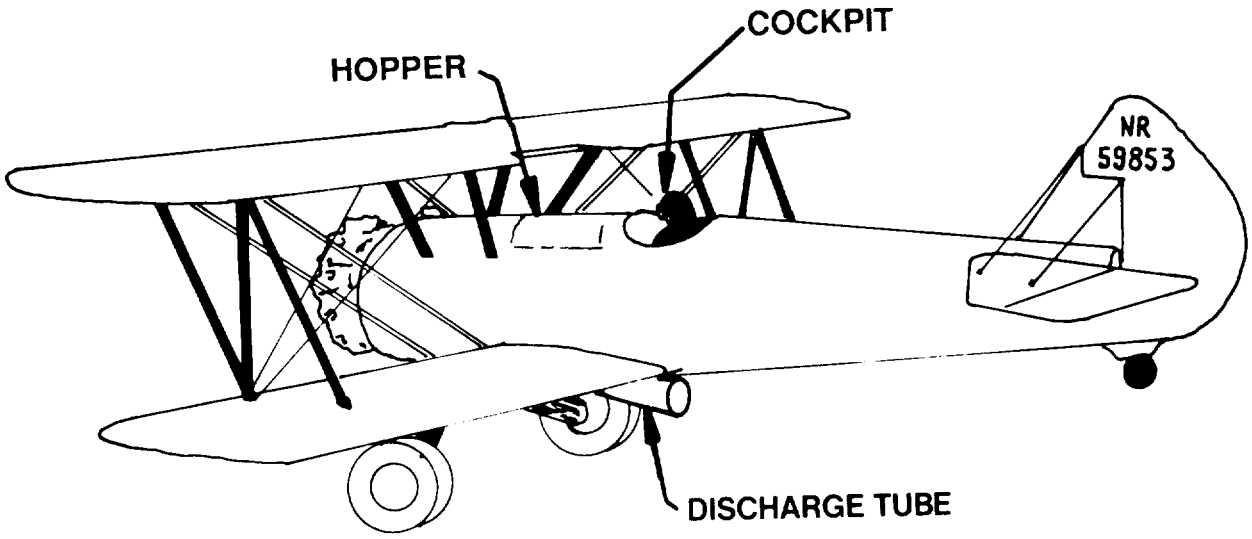
BELL HELICOPTER JET RANGER III
MODEL 206B (TURBINE ENGINE)
1. HOPPER CAPACITY - 160 GALS.
2. WING SPAN - NONE
3. COST (NEW) - $195,000
   CURRENTLY IN PRODUCTION

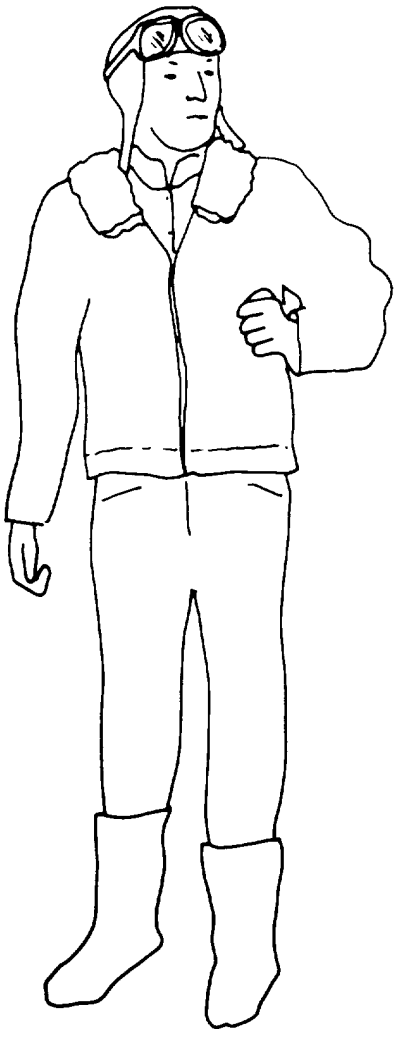


AIR TRACTOR 402 (TURBINE ENGINE)
1. HOPPER CAPACITY - 400 GALS.
2. WING SPAN - 49 FT.
3. COST (NEW) - $325,000
   CURRENTLY IN PRODUCTION

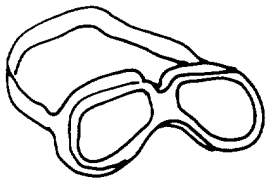


SCHWEIZER AG CAT G164 "SUPER B"
(W/RADIAL ENGINE)
1. HOPPER CAPACITY - 400 GALS.
2. WING SPAN - 42.4 FT.
3. COST (NEW) - $159,000
   CURRENTLY IN PRODUCTION

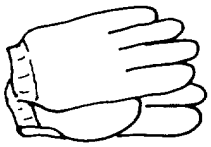




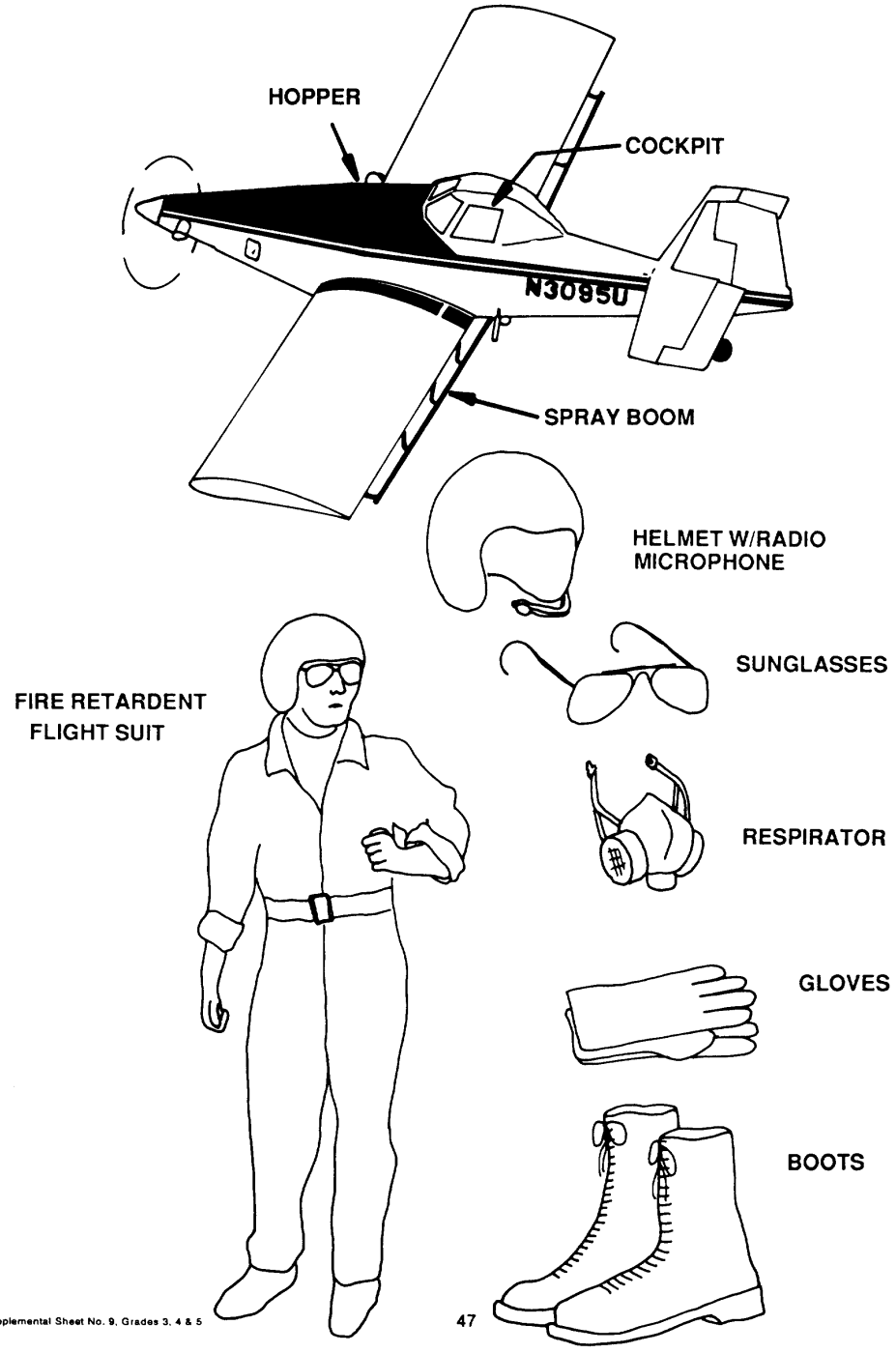
GOGGLES



GLOVES



BOOTS


HOPPER
COCKPIT
N3095U
SPRAY BOOM
HELMET W/RADIO
MICROPHONE
SUNGLASSES
FIRE RETARDENT
FLIGHT SUIT
RESPIRATOR
GLOVES
BOOTS

Andy The Ag-Plane

SUGGESTIONS FOR USE

1. Enlarge the characters if desired, then Cut them out and attach them to a small sack (a forest product) so they become sack puppets.

2. Go through the entire skit using the sack puppets.

3. For the older classes, with longer attention spans, you may want to go through it a second time. The second time use chosen students to handle each puppet. You can make six copies of the play and fold them to resemble a booklet so each student has a 'play book' and then can read their character lines. (The students may wish to make their own covers.) For the younger classes you may want to go through the play for the second time the day after it was introduced using chosen students to handle the puppets.

4. You may want to copy the characters (enlarged) for the students to color or assist them in making puppets of a crop (s) in your area which they can name also.

5. It may be helpful to make some large posters of the characters to leave in the school room. This will remind the students how helpful Andy Ag-Plane is to the producers of food and fiber crops.

6. It may help to copy the words of the poem and the song on a large poster board so the students can follow along more easily.

7. Use your own imagination! You may want to use paper plates (a forest product) for the puppets. Or, if you feel ambitious, you could transfer the characters to a standard pattern to make cloth (a cotton product) puppets.

8. Have fun and be sure the students do too!

Judy Ashton, 1984
Box 218
Goodland, KS 67735
(913) 899-7140

ANDY AG-PLANE: Well, Mother Earth, you know nowadays, the pilots that fly me really have to know what they're doing. They must study hard to get a commercial pilot's license and be well-trained before they get to my controls. I'm confident in my pilot and his experience as an aerial applicator.

MOTHER EARTH: Hey, that's great to know! It makes me feel better, and I'm sure the boys and girls are glad to hear that too... Well, Andy, I know that it's because of you and your Ag-plane friends that the United States is called the 'Food basket of the world'. People here get much more for their food dollar than in any other country in the world. I appreciate what you do for us Andy, and I know these boys and girls do too. Shall we give Andy Ag-plane a hand, boys and girls? (Clap, Clap)

ANDY AG-PLANE: Why, thank you boys and girls. You know, you are the ones I'm really working for, and it really pleases me to feed you and make you happy. I want you to have plenty of food to eat so you can feel good and be healthy and lead better lives... Now, I brought a little song along, that I'd like to dedicate to you. I'd love to have you sing along with me before I fly off. I bet most of you already know the tune from "knick-knack paddy-whack". This is how it goes, and won't you please join me.

(1) This ag-plane , he said, "Come
come and watch me have some fun."

Chorus: "Oh, I fly so high, I fly so low,
I like to watch you plants all grow."

(2) "See that bug, chewing your crop,
I'll fly by and make him stop." Chorus

(3) "See those weeds growing so tall,
I'll fly by and make them small." Chorus

(4) "See that flag waving so high,
I'll spot it and then fly by." Chorus

MOTHER EARTH: Gee, thanks so much, Andy.

ANDY AG-PLANE: And thanks to you boys and girls, for singing with me! And now it's time for me to get back in the air and save some crops. Bye, Mother Earth! Bye, boys and girls! I'll be watching for you as I fly by!

ANDY THE AG-PLANE

MOTHER EARTH: Hi there, boys and girls! I'm Mother Earth, the soil that grows food for you to eat. I've come here today to interview someone very important to each one of you. You know, my soil is meant to produce yummy food for you to eat, but sometimes I have 'pesky problems' and really need some extra help. That's why I wanted to ask some questions of this special someone who really helps me. I see him flying in right now. It's Andy, the Ag-plane, and he's just landed...

Well, hello there Andy, and where did you fly in from today?

ANDY AG-PLANE: Hello, Mother Earth and boys and girls. I've just come from the Jones' field up north. They had about 550 acres of corn that surely needed my help.

MOTHER EARTH: Well, I know you help me in so many ways. I was wondering if you could tell all of these boys and girls some of the wonderful ways you help me.

ANDY AG-PLANE: Of course, Mother Earth. You know, seeds love to grow in your rich-soil. They love the sunshine and rain, and can produce some 'yummy' crops. But, as you are well aware, there can be some very pesky problems.

MOTHER EARTH: Wow! You can say that again? And if those problems aren't taken care of, the food can all be lost.

ANDY AG-PLANE: Speaking of pesky problems, here comes one now. It looks like Barney, the big bad bug. He sure doesn't like to see me come around. Hey, he's bawling!

BARNEY: Boo Hoo!! Boo Hoo!! This is Barney Bug, telling all you bugs that like corn to watch out! They have a new chemical out now, called Bug Zapper. If you see Andy, the Ag-plane heading your way, you'd better hop to another county. Boo Hoo!! Boo Hoo!!

MOTHER EARTH: So he's been one of my problems!!?

ANDY AG-PLANE: That's right, Mother Earth! He may really like a crop you're producing and start chewing on it. It tastes scrumptious to him, and sometimes he can eat it before the boys and girls can get any of it to eat.

MOTHER EARTH: I see !! So you get rid of them, and then my crops can keep on growing.

ANDY AG-PLANE: That's right! But we do have to be careful to do it before the bugs get to a certain stage. That's why I have to fly all day long on some days. I use different kinds of insecticides for different bugs. It can make a big difference as to how much the farmer produces.

MOTHER EARTH: Well, that's great, Andy! I really appreciate knowing that you can take care of the pesky problem of bugs. Are there some other pesky problems that you could tell the boys and girls about?

ANDY AG-PLANE: Do you remember Weeping Wilma, the Wiggly Weed?

MOTHER EARTH: Wow!! Do I ever remember? Why, those weeds almost completely choked out Farmer Tom's wheat last year. I was amazed at the difference after you'd been there. Once those weeds were gone, the wheat perked right up and was able to produce well.

ANDY AG-PLANE: Maybe the memory of Weeping Wilma can tell us something.

WEEPING WILMA: (Sniffle, sniffle) Well, my dear fellow wiggly weeds. I, I want to let you in on a big, big secret. We've been around here so, so long and like this soil so, so well... But, but I just heard that they've invented this, this awful stuff called... Shhhhhh... Walloping weed Wacker, and it, it may be the end of all of us. All I can say is you'd better hope that Andy Ag-Plane isn't flying your way, so long, so long! (Sniffle, sniffle).

MOTHER EARTH: Well, maybe Weeping Wilma was unhappy, but you made the farmer and me happy. Do you use the same chemical on weeds that you used on bugs?

ANDY AG-PLANE: I'm glad you asked that.. No, we use a different kind of chemical for weeds.. We use insecticides on bugs, but we use herbicides on weeds. When we spray weeds, like Weeping Wilma, we also must be careful about our timing. If we wait too long, it can be too late, and those pesky weeds can choke the life out of a plant.

MOTHER EARTH: Well, I know how much you helped me get rid of those destructive weeds. I really did appreciate it, and so did Farmer Tom. Now, Let me see, are there any other pesky problems we should discuss?

ANDY AG-PLANE: Definitely! this pesky problem has a hay day in sugar beets. It's called fungus, and here's Frumpy Freddy, the Fiesty Fungus right now.

FRUMPY FREDDY: Flash! Flash! I have fearfully, frightening news for all of my frumpy fellow fungus friends. It looks like our days may be numbered. I've seen Andy Ag-Plane just a few miles from my field, and he is destroying all of my fiesty fungus relatives with his fungicide. Help! Help! Flash! Flash!

ANDY AG-PLANE: When old Frumpy Freddy and his freaky friends get started on the plants, they spread and multiply very fast. They are really harmful. It's like a disease. It spreads on crops in a similar way that a rash grows on people. It spreads quickly, but if we get to it in time with a chemical called a fungicide, we can stop the fungus from growing. Then the plant can be healthier and produce more food.

MOTHER EARTH: Wow, Andy! You can really help us out!

And here's Captain Curly, the Contented Corn Plant, to say something too.

CAPTAIN CURLY: Ho! Ho! Ho! Am I a happy corn plant now! I was beginning to get crippled, with all those nasty bugs chewing on me. But thanks to Andy Ag-Plane, now I'm all filled out and looking good again. Ho! Ho! Ho! I've even written a poem.

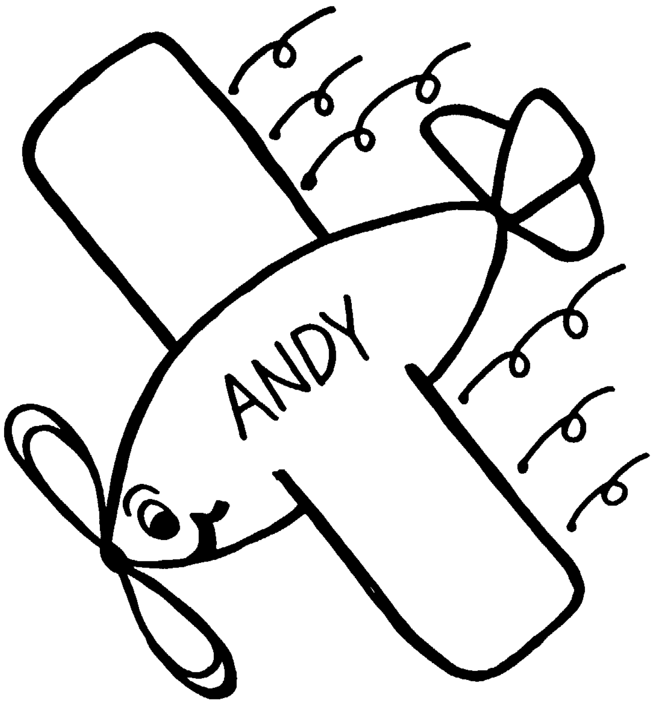
I am a happy corn plant, as happy as can be.
Andy Ag-Plane flew by, and he has saved me.
I am a happy corn plant, as happy as can be.
The bugs have gone away, and I am here to stay.
I am a happy corn plant, as happy as can be.
The weeds are gone now. I am so happy! Wow!

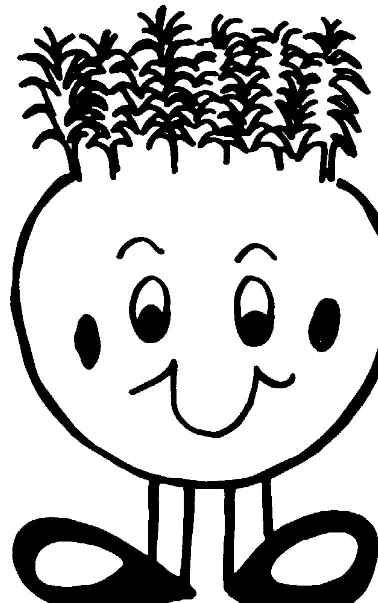
ANDY AG-PLANE: Well, Captain Curly, it really makes me feel good to know I can help you so much.

MOTHER EARTH: Andy, is there another way you help me that the girls and boys should know about?

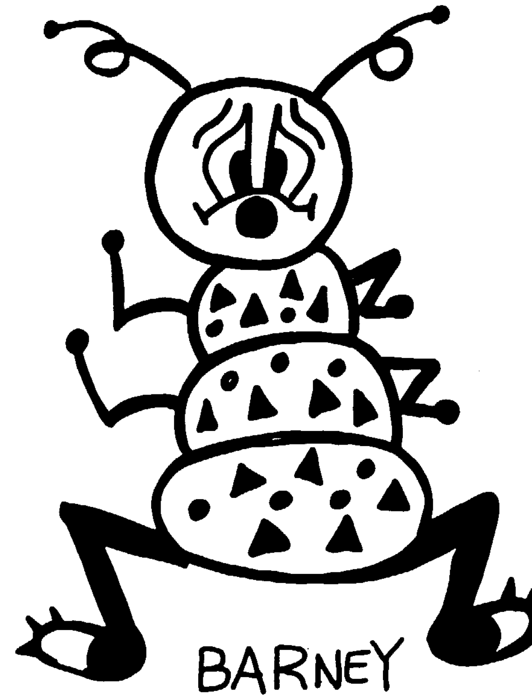
ANDY AG-PLANE: Well, sometimes your soil gets kind of tired and worn out. You may need extra nutrients or food to perk you up. I can fly on a fertilizer to add these nutrients to your soil. It can give the plants the extra boost they need. Sometimes a crop can double it's size if fertilizer is added to weak soil.

MOTHER EARTH: Gee, thanks, Andy, for helping in one more way. Now, I wanted to ask you something about your flying. When you have to fly so close to the ground and close to wires, aren't you frightened?

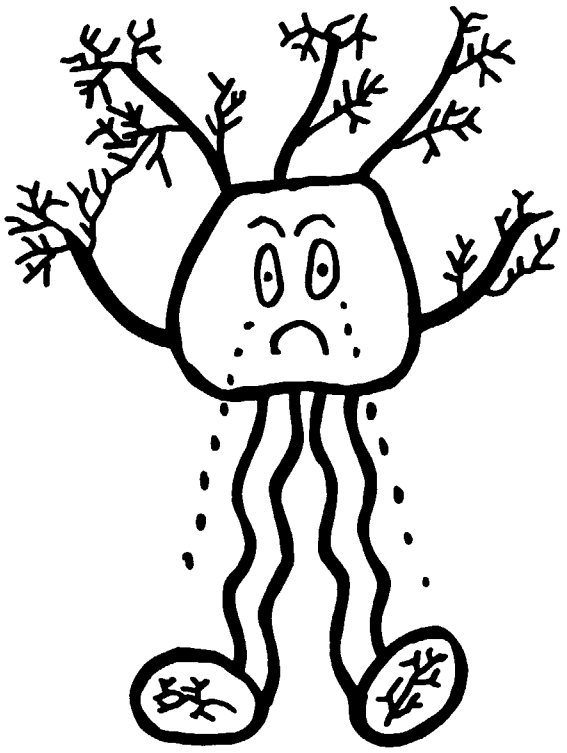




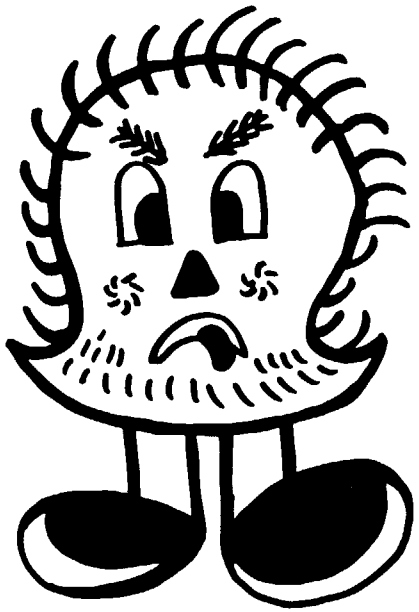
MOTHER EARTH



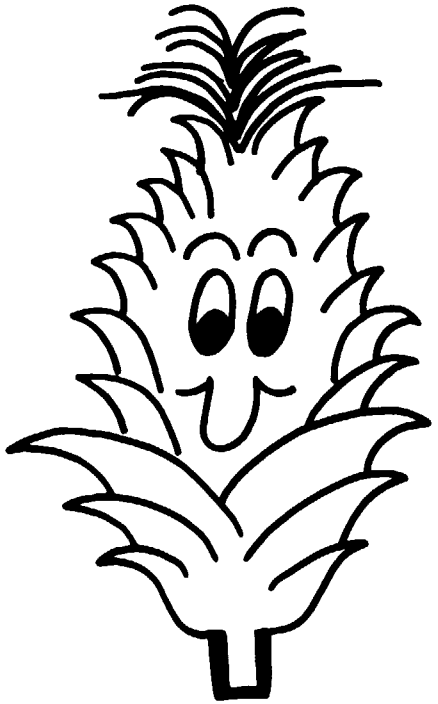
Supplemental Sheet Andy the Ag Plane Characters



WEEPING WILMA



FRUMPY FREDDY



CAPTAIN CURLY

MATERIALS AND RESOURCE LISTING

These sources can supply additional information or direct you to a more suitable source from which to obtain specific information or a classroom speaker. Please contact the listing with your request. If you encounter difficulty obtaining information, contact the National Agricultural Aviation Association Office (address below) or Cynthia Schreiber-Beck, Box 843, Wahpeton, ND 58074, telephone (701) 642-5777.

Your school's film/video library may contain appropriate titles to supplement the information contained in the guide, (example - film or video on the cotton industry). You could enlist the Department of Agriculture and Department of Education in your state to assist you in finding excellent materials to enhance this curriculum guide as well as other units you teach.

AGRICULTURE

Educational Programs and Materials

1. **Ag In the Classroom**: United States Department of Agriculture; Office of the Secretary; Room 234-W; Washington, DC 20250; 202-447-5725.
2. **Agricola**: Reference Branch; National Agricultural Library. Room 111; 10301 Baltimore Blvd.; Beltsville, MD 20705; 301-344-4479.
3. **American Agri-Women**: Route 2, Box 191; Mayetta, KS 66509.
4. **National Farm-City Council:** 225 Touhy Ave.; Park Ridge. IL 60068.
5. **Agriculture Council of America:** 1250 "Eye" St. N.W.; Washington. DC 20005.

RESOURCES

6. County Extension Service Personnel
7. Farm Bureau in your area or state.
8. Grower. Farmer. Rancher from your area.
9. Related Industry Personnel.
10. State Agricultural Associations (ex: State Wheat Growers Association).
11. State Department of Agricultural.
12. State Department of Education.
13. State University Ag. Extension Service.

Colorado Springs. CO 80916.

AGRICULTURAL AVIATION

Agricultural Aircraft Manufacturers

14. **Air Tractor, Inc.:** P.O. Box 485; Olney. TX 76374; 817-564-5616.
15. **Ayres Corporation**: P.O. Box 3090; Albany. GA 31708; 912-883-1440.
16. **Melex USA, Inc.**: 1221 Front St.; Raleigh, NC27609; 91 9-828-7645.
17. **Schwelzer Aircraft Corp.:** P.O. Box 147, Elmira, NY 14902; 607-739-3821.
18. **Weatherly Aviation Co. Inc.:** 50 Skylane Drive; Hollister. CA 95023; 408-637-5534.

ASSOCIATIONS AND MUSEUMS

19. **State or Regional Agricultural Aviation Assoc**. (for address contact National Agricultural Aviation Association).
20. **National Agricultural Aviation Association (NAAA):** 1005 E Street, S.E.; Washington, DC 20003.
21. **National Agricultural Aviation Museum and Hall of Fame:** 1150 Lakeland Drive; Jackson, MS 39216; 601-359-3642.

BOOKS

22. Crop Dusters by Henry Rasmussen, Osceola, WI; Motorbooks International, 1986.
23. **Fire Bombers** by Philip Wallick, London, England: Osprey Published Limited, 1987.
24. **Low & Slow**-An Insider's History of Agricultural Aviation by Mabry Anderson. Clarksdale, MS: Low & Slow Pub lishing Co., 1986.

PERIODICALS

25. **Agricultural Aviation,** Official Publication of the NAAA. Resource of current events, equipment used, people and products in the ag aviation industry. Address: 1005 E. Street, S.E.. Washington, DC 20003.
26. **Ag Pilot International,** Resource of current events in ag aviation worldwide. Address: 405 Main Street, Mount Vernon, WA 98273.

AVIATI0N

Educational Programs and Materials; Information

27. **Academy of Model Aeronautics:** 1810 Samuel Morse Drive; Reston, VA22090; 703-435-0750; (model aircraft).
28. **Air Force Office of Youth Relations:** Kelly Air Force Base; Texas 78241-5000.
29. **Civil Air Patrol (CAP):** Building 714; Maxwell AFB, AL 36112-5572; 205-293-6019; (aerospace education).
30. **Experimental Aircraft Association:** Education Department; EAA Aviation Foundation; Oshkosh, WI 54903-3065.
31. **Federal Aviation Administration (FAA):** Aviation Edu cation, APA-1 00; 800 Independence Avenue, SW; Wash ington, DC 20591; (educational materials & films).
32. **General Aviation Manufacturers Association (GAMA):** 1400 K Street NW, Suite 801; Washington, DC 20005; 202-393-1500; (general aviation).
33. **National Aeronautics and Space Administration (NASA):** Educational Programs Office Code SE; 600 Independence Avenue; Washington. DC 20546; 202-453-1000.
34. **Office of Education**, 0-700; National Air and Space Mu-.seum; Washington, DC 20560.
35. **United States Space Foundation:** 1525 Vapor Trail;

RESOURCES

36. State Aeronautics Department (each state does not have).
37. State Department of Transportation.

ENVIRONMENT

Educational Programs and Materials

38. **The Alliance for a Clean Rural Environment (ACRE):** Suite 900; 115515th Street, NW; Washington, DC 20005; Fax: 202-463-0474. 800-545-5410.
39. **United States Environmental Protection Agency (EPA):** Washington, DC 20460.
40. **USDA/Forest Service:** P.O. Box 96090, 3235 South;

Washington, DC 20090-6090; 202-447-6605.

RESOURCES

41. United States Forest Service Representative

PESTICIDES

Educational Programs and Materials

42. **National Agricultural Chemicals Assoc. (NACA):** The Madison Building; 1155 15th St. NW; Washington. DC 20005.
43. **Oklahoma Farm Bureau:** Information Director; P.O. Box 53332; Oklahoma City. OK 73105.

RESOURCES

44. Agri-Chemical Company Representative.
45. State Department of Agriculture, Pesticide Division.
46. State University Agricultural Extension Service.

CRITIQUE OF NAAACURRICULUM GUIDE

Thank you in advance for your use and critique of this curriculum guide. You, as an educator, are an invaluable source to teach current and accurate information about the agricultural aviation industry. The questions below are to aid in determing the usefulness of this packet, if and where changes should be made, and where more emphasis is required.

Please complete the following:

EDUCATORS'S NAME _____TEACHING AREA _____

MAILING
ADDRESS_____

_____GRADE LEVEL(S)_____

Please circle one:

SCHOOL LOCATION:

AVERAGE % CORRECT ON PRE-TEST: 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

CLARITY OF MATERIAL IN GUIDE: not understandable understandable

PRESENTATION TIME 1hr 2hr 3hr 4hr other

CLASS TIME UTILIZED: 1hr 2hr 3hr 4hr other

USEFULNESS TO TEACHER: information of no value of value highly educational

USEFULNESS TO STUDENTS: of no educational value of value highly educational

INTEREST LEVEL OF STUDENTS: no interest interested very interested

IMPLEMENTATION: unable to use in class useful highly useful

RESOURCES: unable to obtain difficult to obtain easily obtained no order

Your comments/criticisms/suggestions are all we have to learn from. Please add them here. Thank you again for your help.

FOLD INTO A LETTER AND MAIL (ADDRESS IS LISTED ON REVERSE SIDE)

PLACE
POSTAGE
HERE

National Agricultural Aviation Association
1005 E Street, SE
Washington, DC 20003

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