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ABSTRACT

In this module students (grades 7-9) examine some of the many issues related to transportation and consider how different problems impact upon their lives and the lives of others. Student material consists of readings, dilemmas, and activities. These are presented in four sections focusing on land transportation, water transportation, air transportation, and future perspectives. In addition to role playing and simulation exercises, dilemma/discussion formats are utilized to highlight and heighten the underlying issues. Dilemmas are brief stories posing a critical decision to be made by a main character. This decision revolves around conflicts between two or more moral/ethical issues (as identified by Kohlberg) presented in the situation, and it is the moral/ethical implication that provides the thrust for later student discussions. Preceding each dilemma are readings/case studies providing background information regarding issues in the dilemma. Questions are also provided to stimulate thinking about the issues and generate discussions. The module may be used as a separate unit of study, as a mini-course, or incorporated in such subject areas as social studies, language arts, or science. (JN)

PREPARING FOR TOMORROW'S WORLD

Perspectives on Transportation

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Preparing for Tomorrow's World
An Interdisciplinary Curriculum Program

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PREPARING FOR TOMORROW'S WORLD

Perspectives on Transportation

Student's Guide

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PREFACE

We live in an exciting, rapidly changing, and challenging world - a world highly dependent upon science and technology. Our world is changing so rapidly that we sometimes fail to recognize that much of what we today take for granted as common, everyday occurrences existed only in the imaginations of people just a few short years ago. Advances in science and technology have brought many dreams to fruition. Long before today's school children become senior citizens, much of today's "science fiction" will, in fact, become reality. Recall just a few accomplishments which not long ago were viewed as idle dreams:

- *New biomedical advances have made it possible to replace defective hearts, kidneys and other organs*
- *The first air flight at Kitty Hawk lasted only a few seconds. Now, a little over half a century later space ships travel thousands of miles an hour to explore distant planets.*
- *Nuclear technology—of interest a few short years ago because of its destructive potential - could provide humankind with almost limitless supplies of energy for peace-time needs.*
- *Computer technology has made it possible to solve in seconds problems which only a decade ago would require many human lifetimes.*
- *Science and technology have brought us to the brink of controlling weather, earthquakes and other natural phenomena.*

Moreover, the changes which we have been experiencing and to which we have become accustomed are occurring at an increasingly rapid rate. Changes, most futurists forecast, will continue and, in fact, even accelerate as we move into the 21st Century and beyond. But, as Barry Commoner has stated, "There is no such thing as a free lunch." These great advances will not be achieved without a high price. We are now beginning to experience the adverse effects of our great achievements:

- *The world's natural resources are being rapidly depleted.*
- *Our planet's water and air are no longer pure and clean.*
- *Thousands of plant and animal species are threatened with extinction.*
- *Nearly half the world's population suffers from malnutrition.*

While science and technology have given us tremendous power, we are also confronted with an awesome responsibility: to use the power and ability wisely, to make equitable decision tradeoffs, and to make valid and just choices when there is no absolute "right" alternative. Whether we have used our new powers wisely is highly questionable.

Today's youth will soon become society's decision-makers. Will they be capable of improving upon the decision-making of the past? Will they possess the skills and abilities to make effective, equitable, long-range decisions to create a better world?

To the student:

This module has been prepared to help you - the student and future decision maker - function more effectively in a rapidly changing world. Other modules in the *Preparing for Tomorrow's World* program focus on additional issues of current and future importance.

To the teacher:

It is our belief that this module - and indeed the entire *Preparing for Tomorrow's World* program - will help you the teacher prepare the future decision-maker to deal effectively with issues and challenges at the interfaces of science, technology, society. It is our belief that the contents and activities in this program will begin to prepare today's youth to live life to the fullest, in balance with Earth's resources and environmental limits, and to meet the challenges of tomorrow's world.

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CONTENTS

INTRODUCTION

Our modern transportation vehicles provide a wide range of choices for moving us where we wish to go. In addition, they deliver nearly all the food we eat, clothing we wear, and necessities we use in our daily lives.

Today's modes of transportation offer speed, luxury and convenience to meet our many needs. Automobiles, buses and trucks travel through streets and highways moving people and products. Ships and tankers channel through the oceans and along lakes and rivers delivering their supplies, while trains criss-cross the country carrying passengers, mail and other products such as coal, cattle and food. Pipelines transport petroleum and natural gas hundreds of miles throughout the country.

One can safely say that our modern society today is based to a large extent on advances in transportation. For example, when the transcontinental railroad was completed in the 1860's, the United States was effectively linked as a single country. Until then, it took six months to sail from New York to San Francisco. Imagine sending a letter and having to wait a year before receiving an answer!

The development of rapid forms of transportation has made possible the growth of large cities and suburbs. Without our modern network of transporation, our society might have to return to a more agrarian way of life and be limited to the particular food one could grow in the area where one lives.

The benefits of modern transportation, however, do not come easily. Land, sea and air transportation each have different problems and create new types of conflicts. However, problems such as pollution, accidents and huge fuel needs are all associated with motorized transportation.

In this module you will examine different forms of transportation as well as some of the problems associated with transportation. You will be asked to make judgments about the benefits we gain from the different types of transportation. Many of the issues discussed may be new to you, therefore, background articles are included for you to read. The topics addressed in this module have been divided into three categories: land, sea and air transportation. These issues we address are important today and, perhaps, will be even more critical in the future.

SECTION I:
Land Transportation

The articles which follow were selected to provide you with an overview of some of the problems society has encountered with land transportation. By land transportation, we mean the use of vehicles such as automobiles, trucks, buses, trains, motorcycles and other types of wheeled carriers which traverse our streets, highways and rails.

Progress in science and technology has led to new, improved forms of travel since the invention of the wheel. With new inventions have come new types of problems. Hundreds of years ago, land travel was very slow and laborious. It used to take weeks to travel the same distances we travel in just a few hours today. However, in those days, carbon monoxide were words not found in the normal vocabulary. Air, in the days before the automobile, was fresh and clean and free from health hazards. Today our air is not as clean, but we have the convenience and luxury of visiting and traveling to any part of the country by just the turn of the ignition key.

Our society today is so mobile that people can work great distances from their homes with little difficulty, arriving to work daily and on time. Extensive networks of roads and highways link many rural and at one time isolated areas to cities and centers of trade and industry.

How much of this great mobility is necessary?

Is it worth the hazards to ourselves and the environment?

Will we run out of fuel to run our cars?

Should government exert more control on the use and production of cars?

What effects does the auto have on the lifestyle of the people in the United States?

These are the type of questions you will address in this first section. Land transportation comprises the largest section of this module because it is our most common form of transportation. Read the articles, discuss the questions and participate actively in the dilemma discussions. Bring your own knowledge and ideas about land transportation into the discussion.

Reading 1

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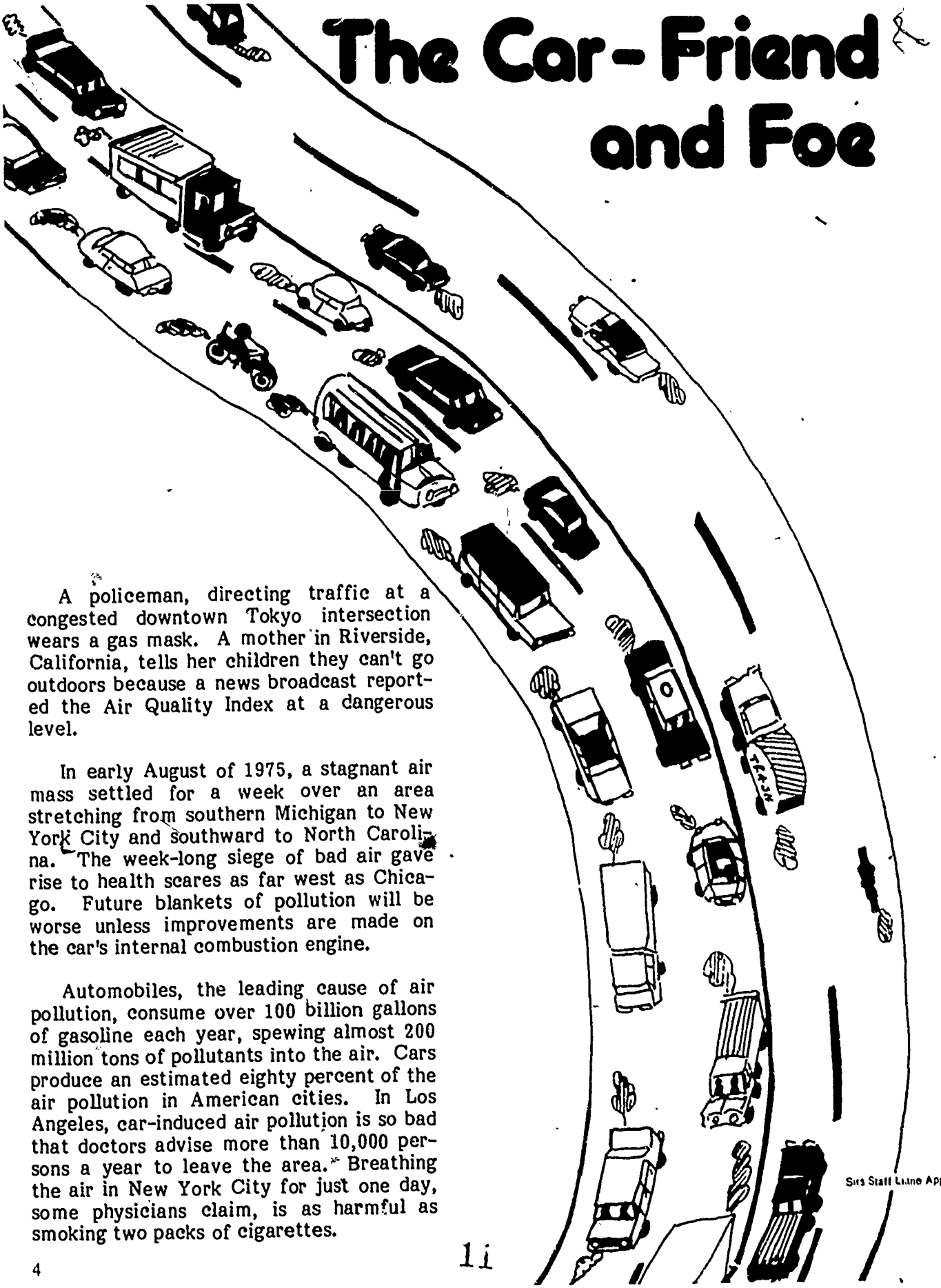
The Car - Friend and Foe



A policeman, directing traffic at a congested downtown Tokyo intersection wears a gas mask. A mother in Riverside, California, tells her children they can't go outdoors because a news broadcast reported the Air Quality Index at a dangerous level.

In early August of 1975, a stagnant air mass settled for a week over an area stretching from southern Michigan to New York City and southward to North Carolina. The week-long siege of bad air gave rise to health scares as far west as Chicago. Future blankets of pollution will be worse unless improvements are made on the car's internal combustion engine.

Automobiles, the leading cause of air pollution, consume over 100 billion gallons of gasoline each year, spewing almost 200 million tons of pollutants into the air. Cars produce an estimated eighty percent of the air pollution in American cities. In Los Angeles, car-induced air pollution is so bad that doctors advise more than 10,000 persons a year to leave the area. Breathing the air in New York City for just one day, some physicians claim, is as harmful as smoking two packs of cigarettes.

We Love Our Cars

Few possessions are as necessary and enjoyable as the car. It represents convenience and freedom. Environmental writer, Allan T. Demarcee, says that "America's fierce allegiance to the automobile was strikingly revealed by two nationwide surveys in 1967 that posed this question: 'The auto pollutes air, creates traffic, demolishes property, and kills people. Is the contribution that the auto makes to our way of life worth this?' " Four out of five people answered yes.

In 1974, the Environmental Protection Agency reported that the "growing army of automobiles has diminished the quality of our lives by polluting our air and our environment." Individuals may love their cars but society is beginning to suffer. Our air is becoming unfit to breathe, traffic is jammed bumper to bumper, noise assaults us from the roadways, gasoline shortages are occurring.

Thousands are Produced Each Day

Meanwhile, the factories of Detroit are adding to the car supply at a rate of 22,000 a day and motor company officials say that number will rise to nearly 41,000 a day by the end of this decade. State highway officials estimate that 40,000 additional freeway miles will be needed to make room for this new onslaught of automobiles. "I don't think it's a crisis," says James M. Roche, chairman of General Motors. "We've talked about congestion for a long time. Back in 1929, people said that no more cars would be sold because there weren't enough roads to handle them."

It was in 1950 that the automobile's contribution to air pollution was revealed in Los Angeles. Before that time, it was believed that auto exhausts had no significant impact on air pollution. The dirty, gray blanket called smog was discovered to be the result of a chemical reaction that occurs when still air and bright sunlight convert hydrocarbons and nitrogen oxides (both emitted from car exhausts) into photochemical oxidants. It is these oxidants that cause eye irritation, dulled senses, impaired vision, and headaches.

Courtesy WHO

Emissions from heating systems in New York add to the pollution created by the car.

Major Components of Auto Pollution

The principal components of automobile pollution are:

Nitrogen Oxide

Nitrogen oxide is a principal ingredient of smog. About 17 million tons are released into the air each year. Almost half of that amount is discharged from auto exhausts. Studies of Chattanooga, Tennessee school children, revealed that acute respiratory illnesses resulted from direct exposure to nitrogen oxides.

Hydrocarbons

Hydrocarbons are organic compounds involved in the photochemical process by which smog is produced. Hydrocarbons are rarely harmful when mixed with outdoor air. They disappear into the atmosphere. However, hydrocarbons help to form photochemical oxidants—a basic ingredient of smog. Cars emit almost 15 millon tons of hydrocarbons each year.

Carbon Monoxide

Carbon monoxide is the most poisonous emission from an auto's exhaust. Every day people are exposed to this compound as drivers, passengers or pedestrians. Brief exposure to high levels of carbon monoxide can cause a variety of disabilities. A constant bombardment of this poisonous chemical will cause death. Several years ago, scientists tested men with mild heart diseases after exposure to 90 minutes of Los Angeles rush-hour freeway traffic. The test disclosed that the level of carboxyhemoglobin in their blood was increased by five percent. Carboxyhemoglobin is a compound which interferes with the life-sustaining transfer of oxygen from the lungs to the body tissues.

Other Effects

Prominent environmentalist, Barry Commoner, believes that the increase of carbon dioxide in the air that is caused by the combustion of fossil fuels will create a warming effect in the earth's atmosphere. This could cause a thawing of the Antarctic ice cap by 40 feet a century. Huge land areas and many coastal cities would then be innundated by rising seas.

However, there are scientists who disagree with Commoner. They foresee an opposite effect from carbon dioxide in the earth's atmosphere. They predict that it will cause an increase in rain and snow and cause a new ice age.

Traffic in Los Angeles

Frank Graham, Jr., a noted writer on the subject of air pollution, estimates that one out of every ten gallons of gasoline poured into an engine, not equipped with smog-control devices, is returned to the atmosphere as pollution.

The Connecticut Agricultural Experiment Station at New Haven found that auto exhausts blanket the countryside, damaging farm crops miles from the nearest highway.

Naturalists believe that lead from car exhausts contributes to the buildup of environmental contaminants and interferes with the reproduction of such birds as the bald eagle.

In August of 1969, a thick, brown layer of chemical wastes descended upon St. Louis. The smog was so dense that motorists drove during the day with their lights on. Public viewing through the planetarium's telescope was canceled because the planets and stars were obscured. Many people were hospitalized with respiratory problems caused by the high incidence of carbon monoxide in the air. People coughed, sneezed and rubbed their eyes. A week went by before the air cleared. By-products from automobile exhausts were largely to blame.

In the last five years, many attempts have been made to develop cleaner internal combustion engines. Most cars constructed since 1970 are equipped with exhaust control systems. The U.S. Public Health Service, however, said that the "expected increase in the number of motor vehicles will far outweigh the partial reductions which can be expected from presently available crankcase and exhaust-control systems."

Polluting, lethal, expensive, but convenient—the car has become part of the American way of life and death. An environmental scientist recently said: "We have paid dearly for the freedom of our automobile. Now we must share the cost to make our air breathable again."

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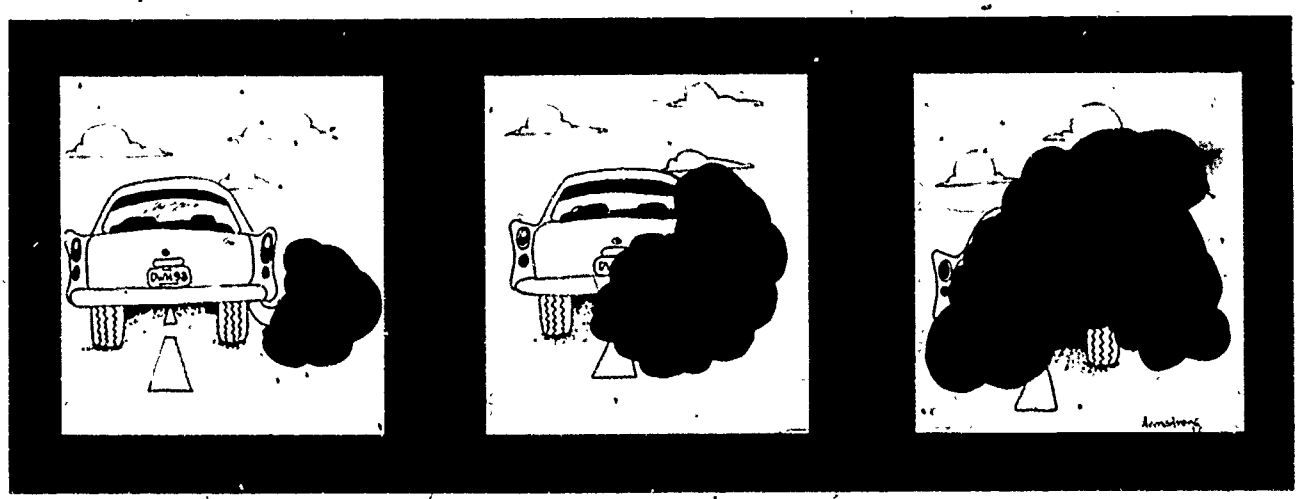


DISCUSSION QUESTIONS: The Car — Friend and Foe

- In what ways does auto travel cause harm to the environment? Are automobiles worth the damage they inflict on our environment, especially our air? Why?
- Why are we so dependent on the personal auto? Is it a necessity or a luxury? Why?
- Should the government put more controls on the production and use of automobiles? If so, what?
- In addition to the initial costs of the auto, gasoline and insurance, what other expenses are incurred when driving a car? What costs are paid indirectly? Who pays for building roads and highways? Are accidents and hospital bills included in the cost? What types of costs are involved in disposing old cars? Can ugly junk yards be considered a cost?
- What are some of the responsibilities one takes on when one owns and operates a car?

DILEMMA 1: "On a Clear Day. . ."

Mayor John Starr is the mayor of a large and crowded city. Large businesses have their offices headquartered here. Many who work in the city live in the surrounding suburbs and drive to work. During the morning and evening rush hours, the exhaust from the commuter cars creates so much pollution that the air becomes unhealthy to breath. Many of the city's residents insist that the mayor ban the driving of cars in the immediate downtown area from 9 to 6. Workers will park their cars on the outskirts of the city and walk to their downtown jobs or use public transportation. (This order will not apply to those physically handicapped and delivery and emergency services.) The residents threaten to block cars from entering the city until the mayor issues the order.

The local merchants angrily oppose the ban because they will lose business. Other plans have been tried to solve the air pollution problem, but they have been unsuccessful. City residents want action now to ban driving in order to clear the air and change this dangerous situation. However, the local merchants feel that if the action is taken, their businesses will suffer greatly; they might even lose their very means to make a living.

Should Mayor Starr ban driving in the downtown area? Why or Why not?

DISCUSSION QUESTIONS:

- As Mayor of the city, what should be Mr. Starr's main concern? Why?
- Is the health of the city's residents more important than a person's business? Why or why not?
- Is there anything the store owners should do to help solve the problem?
- If people become ill from the effects of air pollution, who should be blamed? Why? Who should pay for the cost of medical treatment? Why?
- Should the citizens have the right to carry out their plan to block traffic? Why or why not?
- To whom does the mayor owe his allegiance — the residents or merchants? Why?
- Since the merchants pay more city taxes, should they have more say in the government? Why or why not?
- The merchants are all friends of the mayor; should it be wrong for him to make a decision in their favor? Why or why not?
- Is it fair for the merchants to ask the residents to endanger their health for the merchants' money profits?
- Can you think of any other ways to solve the air pollution problem?

Reading 2

Reprinted from 'U.S. News & World Report.'

PROBLEM FOR CITIES: WHERE TO PUT 36 MILLION MORE CARS

Up and up goes the nation's auto population—even as road building slows. Likely result: more and more traffic jams almost everywhere.

For the millions of drivers already fuming in bumper-to-bumper traffic comes this official word—

Things are going to get a whole lot worse before long.

Tens of thousands more cars, trucks and buses are coming onto the nation's streets and highways every week. They are joining the 134 million vehicles that now struggle for space, causing miles-long jams in and around almost every major city on every working day.

In the next 15 years, the Federal Highway Administration estimates, 36 million more vehicles—most of them automobiles—will be in operation.

To make matters worse, from the drivers' point of view, this will be happening at a time when highway building is slowing to a crawl. It means that the total miles driven each year will increase by 500 billion—to 1.8 trillion annually in 1991—on essentially the same road system that exists today.

"Poor host, harsh landlord." "The city that is not accessible cannot serve its people," Transportation Secretary William T. Coleman, Jr., declared recently. "The city that lacks mobility is a poor host, a harsh landlord."

Yet in city after city, lavish plans for additional freeways turn yellow on the drawing boards—stymied or abandoned because of costs or citizen rebellions.

It was in San Francisco in 1959 that the "freeway revolt" first surfaced. Bowing to complaints that superhighways through urban areas were ugly and compounded the flight of both people and business from the city, the board of supervisors killed four proposed freeway routes in or through San Francisco. Left standing as a monument to the heyday of such construction is the stark, uncompleted end of the two-deck Embarcadero Freeway on the edge of the Bay—now almost universally regarded as a monstrosity in the scenic city.

Today, many urban sectors of California are studded with partially completed freeways, some destined never to be completed, or even used. California's highway-construction program for the next six years calls for only 100 miles of freeway construction, down from 700 miles in the last five years.

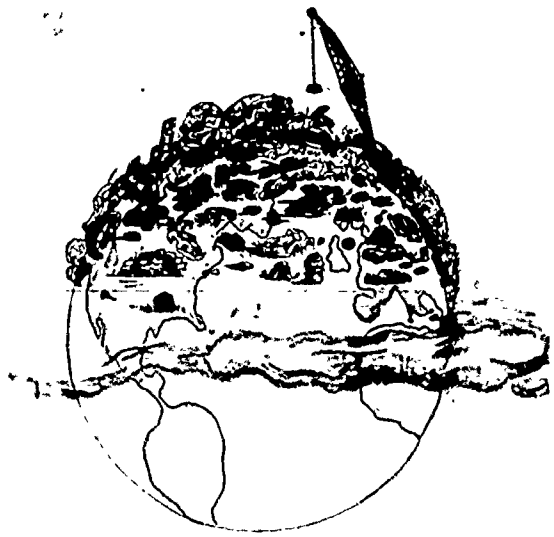
Even in the Los Angeles metropolitan area, long regarded as the epitome of the freeway culture, construction of new roads has slowed, and as many as 17 planned routes may be scrapped.

Boston stopped all new highway construction in 1972. Miami officials have said "no more." Dallas, which planned 400 miles of urban freeways, is settling for a truncated system of 250 miles. In Charlotte, Atlanta, Oklahoma City and elsewhere, the story is much the same. Norman Standerfer, director of planning in Oklahoma City, sums up the situation this way:

"I don't foresee more freeways being built. Cost is the No. 1 problem. The second is that we have made some mistakes in building, and now we are paying our penance to environmentalists."

Among battles lost by planners—

In New Orleans, two major arteries were canceled—one a river-front expressway that would have passed through the famous French Quarter, the other a beltway that environmentalists charged would damage wetlands.



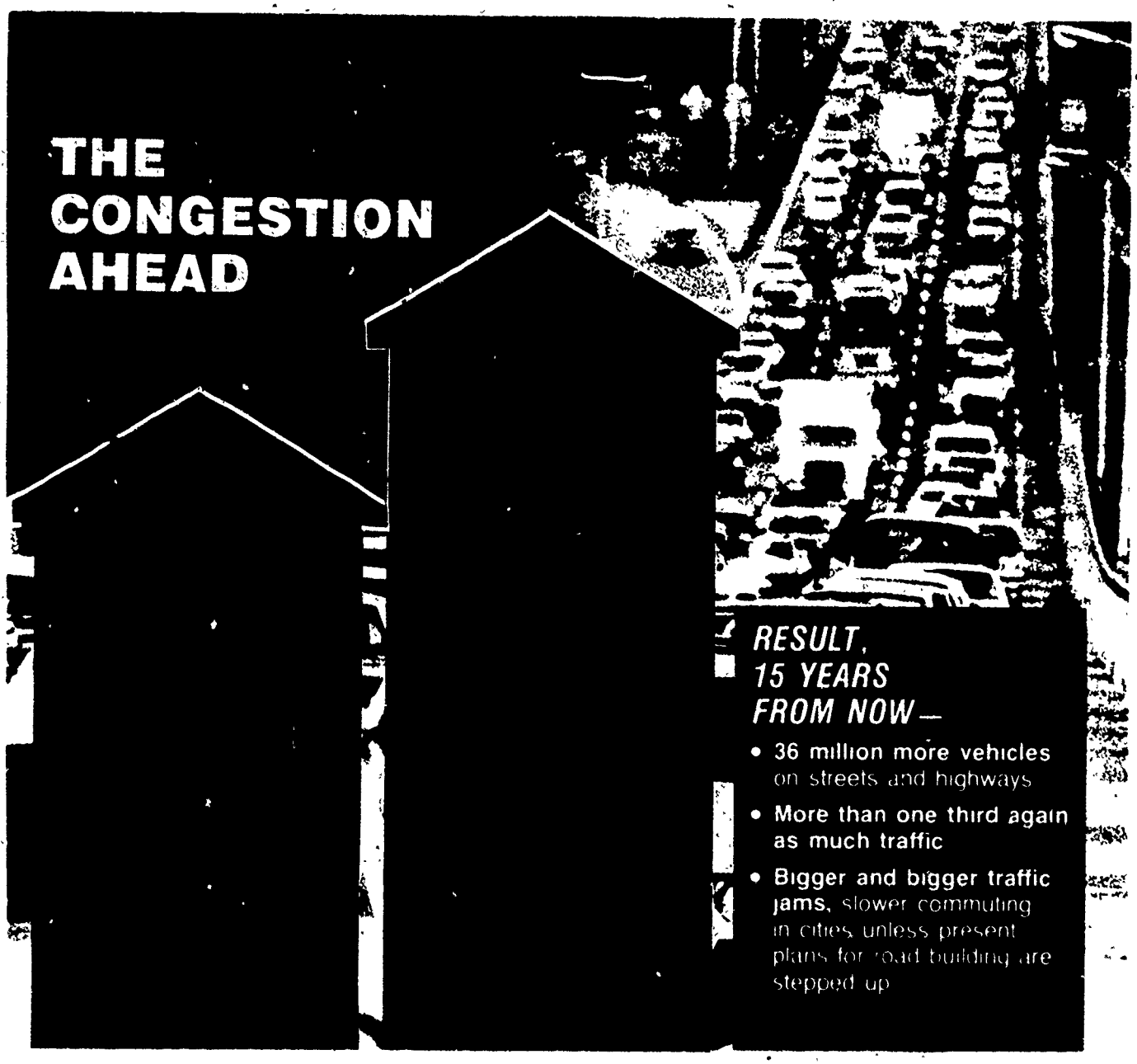
Legal action by the National Wildlife Federation has delayed a 22-mile freeway in the Philadelphia suburbs to the point where officials say that even with a court go-ahead they could not complete the road, originally planned in the 1950s, until possibly 1985.

There are some exceptions to the slowdown in road building. For example, Detroit, American symbol of the automobile, has nearly half a billion dollars in freeway construction in progress. Metropolitan Cleveland has 13 miles under way. In Chicago, Mayor Richard Daley is waging a battle to gain authorization for a 22-mile cross-town expressway to complete his city's plan.

Without more roads, where will all the

U.S. NEWS & WORLD REPORT, Aug. 16, 1976

THE CONGESTION AHEAD



RESULT, 15 YEARS FROM NOW—

- **36 million more vehicles** on streets and highways
- **More than one third again as much traffic**
- **Bigger and bigger traffic jams,** slower commuting in cities unless present plans for road building are stepped up

new cars go? Most current activities are directed toward getting better use out of existing roadways. Special lanes are reserved for buses and car pools in many cities. Others reverse lanes to match the traffic flow, usually providing more space inbound in morning rush hours and outbound in the evenings. Traffic signals are being computerized on major streets to speed the vehicular flow.

Although no single plan is a solution, every little bit helps.

Florida officials say that on heavily traveled U.S. 1 in south Dade County 40 per cent of all peak hour traffic qualifies for special bus and car-pool lanes.

At the same time, some areas are trying to discourage more traffic from entering the central cities. Parking fees are being raised. Off-and-on-street parking is being curtailed.

Yet alternatives available to urban planners often are limited. Usually the choice is a car or a bus. And bus systems rarely are adequate to handle greatly expanded ridership.

Rapid-rail plans. Fixed-rail rapid-transit systems, such as subways, continue to have their advocates. But the time needed to build them—and their cost—tend to limit their effectiveness.

In Washington, D.C., construction began in 1969 on a 100-mile system that is now estimated to cost 5.5 billions when completed in the 1980s. The original figure was 2.5 billions. Atlanta has started work on a 53-mile layout with completion estimated for 1988, some six years beyond first calculations. Baltimore is scheduled to begin digging for an 8-mile line before the end of the year. Miami has plans for a 48-mile system that would be mostly elevated.

New York is working on a 2-billion-dollar line from Central Park to Queens. But a Second Avenue line is in limbo. Three unconnected segments will be completed but, for financial reasons, no further contracts are being let.

In the San Francisco area, the 71-mile BART system is expected to carry 200,000 passengers daily when in full service. Ridership so far is slightly exceeding early projections.

Subways work best when job locations are concentrated. For example, some 66,000 people work in the 21 skyscrapers of New York's Rockefeller Center. The Center has a single garage with 728 spaces. Monthly parking is $135.

Almost everywhere else, however, the automobile will remain by far the major mode of transportation for the foreseeable future. With 36 million more vehicles in the next 15 years, cities somehow will have to learn to adjust.

DILEMMA 2: "One Less for the Road"

The United States Congress is about to vote on a new transportation bill. The bill will limit each household to only *one* automobile and that car must be able to travel at least 30 miles on one gallon of gasoline. Authors of the bill believe that such a law will reduce air pollution deaths caused by automobiles and traffic congestion. The bill would become law two years from the time of passage in order to give people time to adjust to the law.

Congresswoman Smyth has to vote on this bill but is undecided on how to vote. She represents a state whose major industry is the production of automobiles. If fewer cars are needed, the entire economy of the state would come to a standstill. In addition to the concerns of the auto makers, she received letters from her voters urging her not to support this bill. They argue that many families will have problems continuing their daily activities with just one car. At the same time, she has received letters from environmentalists and concerned citizens telling her of the dangerous effects of auto pollution. They argue that air pollution is becoming a serious health hazard in many parts of the country. More lives are endangered the longer air pollution and congestion are not controlled.

Should Congresswoman Smyth vote for the bill? Why or why not?

DISCUSSION QUESTIONS

- What should be Congresswoman Smyth's main concern when she makes her decision? Why?
- If Congresswoman Smyth votes *yes* on the bill, whose rights will be jeopardized?
- If Congresswoman Smyth votes *no*, whose rights will be jeopardized?
- Should people be asked to give up their right to travel and convenience to protect their health and environment? Why or why not?
- In families where both father and mother work and have to drive in different directions, is it possible to get along with only one car? In what ways might they have to change their daily activities/schedules?
- Will people in cities, suburbs or the country be affected differently? How might such a law affect you? What adjustments might you have to make? What activities requiring auto travel might be hard for you to give up? Why?
- Should the government have the right to limit what people buy? Why or why not?
- What responsibilities do people have towards the environment in which they live?

ACTIVITY 1: Road Maps and Their Uses

An important item for any mode of transportation is a map. Travelers in any type of vehicle rely, to a great extent, on the proper use of a directional map. The following exercise will help review your map reading skills and perhaps add to what you already know.

Obtain a road map which depicts the following states: Massachusetts, Connecticut, Pennsylvania, New York, New Jersey, Delaware and Maryland. This map should be large enough so that you can easily distinguish the different roadways. A map for the mid-Atlantic states is a good example to use. The questions will guide you in the examination and interpretation of this map and help you discover other useful information in addition to finding one's way from one city to another.

QUESTIONS

1. Name three cities with a population over 50,000:

   _____, _____, _____

2. What roads might one take to get from Boston to Philadelphia?

3. Which road would you select to make such a trip? What factors would you have to consider in making the decision?

4. What is the approximate distance between Boston and Philadelphia? In miles? In kilometers? By which route?

5. If a car averages 15 miles to a gallon of gasoline, how many gallons would it use on a trip from Baltimore to Atlantic City?

6. How much would it cost to drive from Scranton, Pa. to Allentown, Pa.? (Assume that the cost of gasoline is $1.50 per gallon, and your car averages 15 miles to a gallon of gasoline.)

7. What are the interstate highways which run from New York to Boston?

8. Which route might you take if you wanted to do a great deal of sightseeing from New York to Boston? Why?

9. At the present speed limit of 55 mph, how long would it take to travel from Baltimore to Wilmington? (Assume no traffic jams, just continuous driving) Using which route?

10. What are some of the major benefits of such a road map? What other things do you learn from a road map?

11. On what type of road might one find the greatest number of facilities (e.g., rest stops, service stations, restaurants)? Interstate highway or state highway?

Reading 3

The Nation's Tragedy

4 Million Hurt in '75; Cost Was $37 Billion

By Phil McCombs
Washington Post Staff Writer

Jo Marie Riccobono had been out of high school for a year when her life and dreams were shattered in a head-on automobile accident.

"I had no pulse when they took me to the hospital and they all said I wouldn't make it through the night," she said, her voice laboring slowly with the words and punctuated by the sharp sucking noises of her breathing.

"The neurosurgeon said it was a miracle that I lived. I developed pneumonia, meningitis, stress ulcer. I started bleeding internally. I had a fractured skull . . . They even tried a new drug on me--it made my hair fall out."

The details of her travail in the four years since her accident are almost too terrible to recount. From the busy world of high school and young adulthood with its familiar pleasures and frustrations she was plunged into a struggle for survival.

Veiwed in another way, however, Jo Marie's story is an odyssey: a triumph of the spirit over adversity.

"They said I'd never get out of bed,"she said, "but I got up. Then they said I'd be in a wheelchair forever, but I proved that wrong too. People, prayers and love--that's what brought me through. There's so many people who are worse off than I am. Now I would like to get better and help them. I think I've found the true meaning of love."

Jo Marie, who is now 22, had been driving her 1969 Ford Fairlane on the way to visit her boyfriend when she had the accident.

She blacked out and was in a coma for six weeks. Now she has no memory at all of how the accident happened, although she was habitually a safe driver and was not cited.

"The guy who hit me, he had one scratch over his eye and he was released from the hospital the next day," she said. That's what I call fate."

The doctors tell her now that the details of the accident are "locked up" in her mind and that psychotherapy would bring them to light and would dissolve the terror of automobiles that she now has.

"I don't know if I'm going to drive again," she said. "Right now I have no desire."

She rides as a passenger, however, and said she "can't believe all the things I see, all the crazy people, the chances they take, the hot-headed drivers. If I see something that kind of frightens me, I freeze."

She freezes often. Her experience has caused her to step back and look with dismay on aspects of the car culture that she was once part of.

"I think the things you hear on the radio have a big influence on the way you drive," she said. "It kind of psychs up your mind: "Here's the cool dude riding a motorcycle, flirting with girls." Then you kinda get the idea why can't you do it? Or like if there's a song playing on the radio and you're driving, and the song is very fast and hip, you kinda like keep beat with the foot pedal. Or my father: if he plays soft music, it kind of puts him to sleep . . . when you first come out of school it's something new, you get your license and all. Maybe you take unnecessary chances. . ."

Jo Marie had been an attractive and popular girl at Alfred G. Berner High School in Massapequa, N.Y., her home town.

Her yearbook, which she displayed along with other cherished momentos of the past, contained her class picture--a young women with a serious, high-minded expression, eyebrows arched and thin.

The caption noted her activities: "Beacon managing editor, drama club, volleyball, pep club, ski club, chorus, jr. council . . ."

The yearbook had its share of warm inscriptions from friends. Someone named Wayne had written prophetically, "Success should be measured by what obstacles you have over-come . . "

Jo Marie had big dreams in high school of becoming an executive secretary in Manhattan, but she had studied a trade--cosmetology--in her last two years as a more pratical alternative.

After graduation she got a job as a manicurist and needed a car to go back and forth to work. She spent $1,000 for the light green Ford with its vinyl black top. She said it was "neat, clean, sharp-looking, but not souped up or anything." Just a car.

In that year after graduation Jo Marie became unhappy and began putting on a lot of weight. Her dreams of being a secretary in the city were withering and she didn't like her job.

"I couldnt find myself," she said. "I wasn't sure what I wanted." Then came the accident, the end of the old life and the begining of a new one.

Jo Marie was in the hospital and then in therapy for six months.

"When I went to therapy I had no coordination," she said. "I had to learn to walk, to eat, like, baby food and gradually I could take it ground up. Now that I have coordination, I can cut it up fine enough where I can swallow it."

She had to learn to talk all over again, too, because at first her words "sounded like mush."

Her hands still shook as she handled a coffee cup in her mother's kitchen during an interview, and one eye was taped shut because of her double vision.

At one point, she said, she almost went blind when her eyes dried up after they were neglected by hospital personnel who "thought I would die;"

She improved month by month, aided by the loving help of her large family and her own renewed religious commitment in the Catholic Church.

There were cruel blows, too.

"After I got hurt my boyfriend told me he wanted to go out with other girls and I was in no position to say anything," she said. "I felt like I was all messed up and of course he didn't want me now. . . I had his ring. That's the only reason he kept in touch, and after I gave the ring back I never heard from him." He has since married someone else, she said.

Jo Marie lives on faith now. She believes that her double vision will gradually improve, and has resisted plastic surgery and other operations. Already, she said, the paralyzed side of her face is begining to "thaw out" naturally.

"Now I would like to get well and go into some kind of medical work, physical therapy, somewhere where I can help people," she said. "I want to work with human life. I don't want to work with material things like I did before. Before I was hurt, materialistic things meant a lot, but now I have a different outlook. . ."

Automobile deaths in the U.S. have declined to about 45,000 a year from a 1972 high of 56,000 with the imposition of the 55 miles-an-hour speed limit and various safety measures. Yet the human, economic and social costs of auto accidents remain almost beyond imagination.

More than 2 million persons have died in auto accidents in the U.S. in this century, or more than three times the 652,000 battle deaths the U.S. sustained in all the wars it ever fought.

Four million persons were injured in auto accidents in 1975 alone, and while most of these were minor injuries, this figure for only one year is still double the 1,904,000 total of all battle deaths and wounds in all our wars.

In a study prepared for the National Highway Traffic Safety Administration, Barbara Moyer Faigin attempted to put a price tag on the total costs of motor vehicle accidents.

She included costs for medical care, funerals, legal work, and vehicle damage, plus loss estimates of productivity in work, family life and community service.

Her figures are stunning: the total cost of fatalities, injuries and property-damage-only accidents amounted to $37.6 billion in 1975 alone.

Faigin put the average cost of a fatality at $287,175 and of an injury at $3,185. Each of the nearly 22 million property-damage-only accidents in 1975 cost an average of $520, she found.

The vast carnage has been held somewhat in check by federal laws mandating seat belts and other safety measures. Still other measures seem to have been prevented by American values of freedom and privacy.

Last year, for example, the District of Columbia abolished a program aimed at identifying potential drunken drivers through a highly personal questionnaire after objections were raised by the American Civil Liberties Union and others.

In 1975, an unpublished study of Montogomery County school bus drivers found that personality tests could be used to establish a standard profile of a safe school bus driver, yet the county didn't implement such testing.

"It's just a no-no," said Francis Kenel, the American Automobile Association's safety expert. "To what degree do you permit an invasion of privacy?. . . People react very negatively to it, and I feel that way too."

Auto manufacturers have seized upon such issues in their battle against goverment regulation.

"The automobile represents freedom," said General Motors chairman Thomas A. Murphy in a speech early this year. He warned against "the steady encroachment of the goverment upon our business" and lashed out against those in the media who he said oppose the car culture because they "prefer apartments to split-levels and boutiques to supermarkets."

Murphy quoted economist Paul McCracken on "the age-old struggle between those who believe that people should be forced to fit into the blueprint pattern of proper living--the blueprint being decided by goverment or some other 'superior' group--and the people themselves who within a framework of rules prefer to work out their own destiny."

Yet after all that Murphy admitted that "the automobile today is the product most complained about" and that much of the blame "lies within our own industry."

Ben Kelley of the Insurance Institute for Highway Safety, a research organization, said that views like Murphy's have been dragged out merely to cover up a basic resistance to safety and other improvements.

Kelley said that auto manufacturers set up a "pattern of resistance over 2½ decades " to seat belts. Now, he said, they are resisting air bags.

"GM and Ford say the marketplace will determine whether people want air bags. . . and that the consumer's freedom of choice should be preserved," Kelley said. "That sounds very nice until you begin to think about it: you can't buy an airbag in the U.S. today. What kind of freedom of choice is that?"

Kelley quoted federal estimates that if autos had front-seat airbags there would be 9,000 fewer deaths and half a million fewer injuries in auto accidents each year.

A New York State study of auto crashes found that the use of seat belts cut death rates in half. And Insurance Institute research showed that Australian laws requiring car occupants to use available belts resulted in a 21 per cent decrease in fatalities in metropolitan areas and a 10 per cent decrease in nonmetropolitan areas.

Kelley said that most crashes are survivable today without serious injury at speeds between 25 and 30 mph and that the technology is available to push that figure very close to 55 mph.

"All the technology is in place to substantially reduce injury and death," he said. "The question is will we as a society require those who build these things to do it?"

Kelley said that reducing overall speeds is another way to cut deaths and injuries but that the logical solution of producing cars that can't go over 55 mph . . . is a "taboo subject" in our society.

He said that even a built-in limit of 70 m.p.h. could reduce crash fatalities by 10 per cent annually.

"We put our kids in cars that go 120 and say, 'Be nice and go 50.' Then when they get killed we say they were wrong. Now what kind of a society does that? It's shameful."

There is no question that smaller cars are more dangerous than big ones.

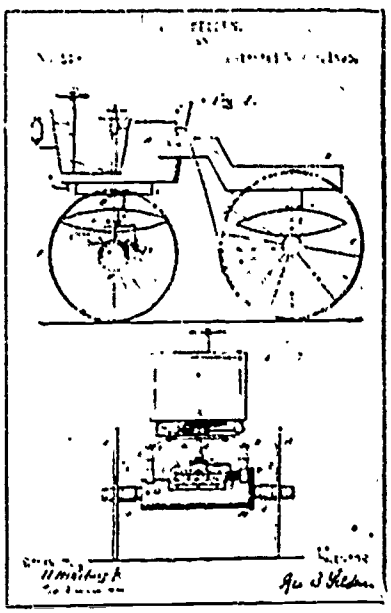
The Insurance Institute data showed that the chances of severe injury and death increase "especially rapidly" in cars weighing less than 3,000 pounds.

If small cars are worse in accidents, many people believe they may also be more prone to accidents.

"People can't see you, that's a real serious problem," said George Daniels, who owns a tiny MG Midget. "I need to paint my antenna orange and put a flag on it. I've had people sideswipe me three of four times changing lanes. I had a guy back into me once--evidently he didn't see it."

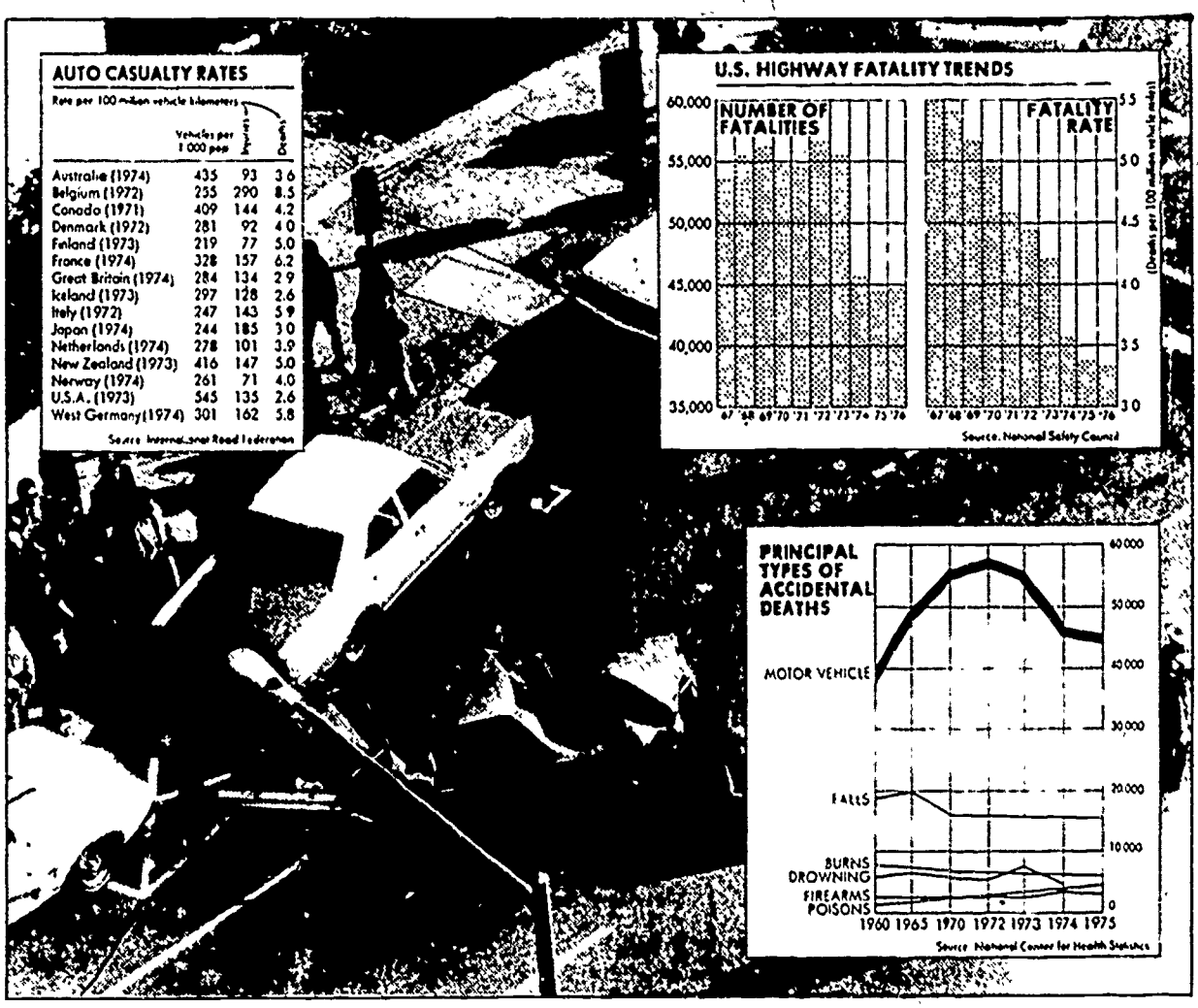
Still, Daniels, a Montgomery County resident, is willing to take a chance. His car is comfortable on long trips that he makes as a Pentagon contract negotiator.

"I just can't see myself in a VW,' he said, referring to a car higher and more visible than his own.



The Washington Post

First patented gasoline automobile was invented by George B. Selden. The patent caused a long dispute with Ford Motor Car Co., which argued that it was an effort to monopolize the industry. Case eventually was decided in favor of the Ford company, but Selden's patent was never declared invalid.



By Dave Cook—The Washington Post

DILEMMA 3: "How Safe is Safe?"

Today was the first day Mark had driven the family car to school. The occasion was the football game with their chief rivals at Foxwood. When his friends learned that he had "wheels," they immediately wanted rides. Mark was, of course, pleased that he could finally drive his friends around. He was one of the few in his junior class who drove.

There was one hitch! Before his parents let him use the family car, Mark had to make one promise. If he took any riders, he had to make sure each person wore a seat belt. Mark agreed.

As his friends piled into the car and squeezed into the seats, Mark had second thoughts about the promise he made. Although Mark was used to wearing a seat belt whenever he rode in a car, he knew that none of his friends ever did. They felt that wearing seat belts wasn't "cool" and was really a bother.

Mark knew that seat belts do reduce injuries in accidents. But what would his friends think of him if he made them wear seat belts? Also, there were only five sets of seat belts and seven passengers. If he kept to his promise, two would have to get out.

What should Mark do?

DISCUSSION QUESTIONS

- Should Mark break his promise to his parents? Why or why not?
- Do you think his parents will still trust him if they find out that he broke a promise? How important is keeping a promise?
- Seat belts are required on all cars, yet many people don't wear them. What reasons do people give for not wearing seat belts?
- If seat belts reduce the severity of injuries, why is there so much resistance to their use? (Experts estimate that 10,000 lives can be saved each year if 75% of drivers wore their seat belts.)
- Does Mark have a right to tell his friends what to do, even if it's for their own safety?
- Should people have the right to choose what they want to do even if it is dangerous? Why or why not?
- Do you think that Mark's parents are being too strict? Why?
- How do you think Mark might feel if he had an accident and his friends were seriously hurt or killed because they didn't wear seat belts?
- What would you do if you were in Mark's place? Is it hard to force your friends to do something they don't want to do?
- How important is the "freedom of choice" when the situation involves the question of health and safety? Why?
- Because many people do not use seat belts the government will require new cars to be fitted with air bags. This will add several hundred dollars more to the price of the car. What are your feelings about air bags?
- When a new technology is developed that will improve safety, should the government insist that people use it? Why or why not?
- Some states no longer require motorcyclists to wear helmets. The cyclists had insisted that it was their right to decide whether or not to wear helmets. Should the states have withdrawn that law? Why or why not?

ACTIVITY 2: The Selling of the Car

Introduction:

In the fiercely competitive auto industry, advertising plays a large role in attracting car buyers. Advertising is a major activity for all auto companies. Auto makers sell potential customers on the benefits of their cars through the television and radio commercials as well as newspapers and magazine advertisements. Many of the autos purchased today by consumers are directly related to the advertisements created by the advertisers.

Very often consumers actually buy the product because they are enticed by the advertisement, not by the actual quality of the product. Words such as luxury, sporty, style, etc. are all used in order to attract the consumer to the car. It is conceivable that a person could buy a car that he/she originally had no intention of buying because he/she is influenced by the advertising. A catchy jingle or a slogan proclaiming the glorious benefits gained from owning a particular car can long remain in a person's mind.

Instructions:

Bring into class several examples of automobile ads found in newspapers, magazines or brochures.

- Examine carefully the words and pictures used in these ads. What do you think the car maker is trying to sell? Style? Comfort? Safety? Economy? Image (what others think when you drive a certain type of car)?
- Complete Handout 2 according to the following directions:
  - In the first column list the name of car and the source of that car ad (name of magazine, newspaper or dealers' brochures).
  - Examine each ad and try to find terms that fit into the categories listed on the handout. For each of the categories indicate the words or phrases used in the ad to describe it. (Not all characteristics of a car are described in an ad. If some items are not mentioned, put a line through that "box.") In many cases the ad does not directly refer to the categories as listed but describes or lists different items on the car. These should give you clues as to the message the ad is trying to convey. (For example, if the ad lists items such as power locks, power windows, stereo radios, you might infer that a "special feature" of the car is *luxury*. On the chart write in *luxury* and list those items that give you that impression.)
- When you have completed the chart, meet in small groups of 3-5 students. Share with one another each person's findings. What are some of the similarities? Differences?
- In your small groups discuss the following questions:
  - What appears to be the main theme of each ad? How many different themes are used? How many ads use each of these themes?
  - For each theme how does the auto manufacturer try to appeal to the buyer? (e.g., If the theme is "economy", does the ad focus on the cost of the car, fuel mileage, or low repair rate?)
  - In conveying a certain idea, does the ad back it up with real facts; or is it left for you to infer?
  - What facts/statements have the ads omitted which you think are important to know when buying a car?
  - Do the ads give you any feelings about the type of people who drive a certain "make of car"? What are some of these personality types? (Fun loving? Sporty? Rich?)
  - How much does the ad tell and how much is left to the imagination?
  - If you were buying a car, do you think that you can make a choice on the basis of the ad?
  - Do you think that the ad is trying to sell what the customer wants?
  - How important is safety, the quality of the engineering, the durability, and new improvements?
- As a group, prepare a brief 5-minute summary on auto advertisement based on the ideas brought out in your discussion. Include in this presentation your conclusions about what the ads try to sell and how well the messages come across. (Select a representative(s) from your group to make the presentation.)
- After all the groups have given their reports, the entire class may wish to discuss the following questions:
  - To what extent do you think advertising influences the consumer's choice? What evidence do you have for your conclusion?
  - Do you think the advertisement tries to sell you what you do not want or does it try to appeal to your desires and needs? (Think of the different ways you reacted to the ads.)
  - To what extent do you think the consumer influences the type of car produced by the manufacturer?
  - Do you think that there should be more advertising? Less advertising? Who pays for the advertising?
  - What might happen if there were no advertising? Do you think this might be desirable? Undesirable?
  - How might you feel if all cars were exactly identical and you could no longer shop around for the "car of your dreams?"

THE CAR MAKER'S SELLING TECHNIQUE

Name of Car (and where ad was found)	Styling	Economy	Special Features	Safety	Image	What impressions do you get from the picture?
1)						
2)						
3)						
4)						
5)						
6)						

ACTIVITY 3: Reinventing the Car

American cars burn approximately 6 million barrels of oil each day. A sudden halt in oil production can bring everything to an abrupt stop. Yet the grim prospect of no gasoline in the future is very real. There is only so much oil in the ground. Some studies have forecasted severe oil shortages in the next twenty years. Even if new oil fields were discovered, keeping the world's gas tanks filled will be increasingly more difficult. As lesser developed countries become industrialized, they will also buy more cars. More cars simply mean more demand for oil. With a limited amount of oil and a growing number of customers, the future is quite clear. The price of gasoline will continue to go up. The long gas lines we had a few years ago may well become a permanent scene.

Will you be driving 10 years from now? What will you drive?

It is obvious that future cars will have to use less gasoline. We will no longer be able to roar down the highway at top speed. Synthetic fuels (or synfuels) need to be developed. All these factors will mean changes in what we drive and how we drive.

Some of the possible new developments and changes include the following:

- By 1985 half the cars on the road will be four cylinders.
- Steel bodies will be replaced by aluminum or other light-weight materials such as fiberglass and reinforced plastic.
- Car size will be reduced.
- More cars will be powered by diesel fuel. Diesel cars use about 25% less fuel but diesels emit more pollutants, some of which are suspected to cause cancer.
- Some cars will be designed to use alcohol or other synthetic fuel.
- A car proposed for city driving is a two-passenger car powered by a motorcycle-like engine. Weighing about a thousand pounds, it could travel 50 to 60 miles on one gallon of gasoline.
- Electric cars may make a comeback. They will reduce the need for petroleum because electricity can be generated from nuclear or coal-fired power plants. However, they will be heavier in order to support the heavy batteries, slower moving and require recharging every 150 or 200 miles. Charging stations will appear on the roadside scene to recharge batteries when the car is not in use.
- Manual transmission will be found in more cars because automatics use 10% more fuel.
- Maximum speed of cars can be reduced. A car, for example, which travels at a top speed of 65 miles per hour is powered by a smaller, less expensive engine.
- New types of engines are on the drawing boards. One is the Stirling engine which runs on the principle of external combustion. Heat from the burning fuel causes a gas under pressure to expand and drive the piston. The major problem with the engine is that it runs very hot and will be expensive to build and maintain.
- Microcomputer chips will be used to control many of the car's operations. By controlling very precisely the amounts of air and fuel, the engine will run more efficiently and save fuel. Computers can be used as sensing devices to keep a check on the different running parts. The driver will be alerted to car troubles before an actual breakdown.

Instructions:

- Meet in small groups of 3 or 4 students. Discuss some of the ideas presented above.
- As a group develop/design a car of the future. You may wish to do some additional outside research.
- Consider the following questions as you design your car.
  - What are the important features? Safety? Fuel economy?
  - How will the car differ from cars we know today?
  - How will the car be powered or what types of fuel will it use?
  - What size and shape is most efficient?
  - How important is styling?
  - What special devices will you include to improve safety?
  - In what ways can fuel be conserved?
  - What new inventions will help to improve cars today?
- After you design your future car, prepare an ad or commercial for it.
  - How will you attract people to buy your car?
  - Will people need to change their driving habits when they own this car? Will it be easy for them to change and how can you convince them to change?
  - What features on the car will you stress? Are there any features you don't want to stress?
  - What strategy or technique will best convince people to buy your car?
  - What are the most unique aspects of your car?

- What information will be most useful to the customer?
- What are the disadvantages of your car? Should they be pointed out? Why or why not?

- Present your ad or commercial to the class.
  - What do you think of the new cars?
  - Did the cars differ much from one another? What were the main differences?
  - What major changes will occur on the American highway scene when these cars appear on the road? (e.g., What types of new services might service stations need to provide? If cars are smaller, could lanes be made smaller so additional highway lanes are created and traffic congestion is reduced?)
  - Will the new cars encourage people to drive as much? (e.g., Will people want to take long trips in small cars that are less comfortable?)

Reading 4

Prospects For The Automobile: Sputtering Toward The Twenty-First Century

by Steve Olson

One of the next two decades' most important events will be the peak and subsequent decline of global petroleum production. No one knows exactly when this peak will occur, since it will depend so heavily on the unpredictable decisions of several of the world's major oil producers, particularly Saudi Arabia. But the gradual reduction of world oil supplies will do more than mark a new age for the automobile; it will signal a new phase in the world's economic history.

The global demand for petroleum will continue to grow throughout the next two decades, stoked by the expanding economies and automobile fleets of the industrialized and developing countries alike. Projecting petroleum supply and demand into the future, a gap is seen to appear and widen. One study of future energy supplies, prepared by the Workshop on Alternative Energy Strategies, predicts that this gap between supply and demand will amount to one-quarter to one-third of total demand by the year 2000.

• • •

If petroleum does become increasingly scarce, synthetic fuels, or synfuels, might be able to take up much of the slack. Already the federal government is increasing its commitment to synfuels. With immediate development, they could come into widespread use sometime during the 1980s.

Synthetic fuels fall into two broad categories. In the first are those that would require no changes in today's conventional auto engines. These include synthetic petroleum made from shale oil, coal, and tar sands, plus blends of gasoline and alcohol (gasohol). In the second category are those synfuels, such as pure alcohol, that would require substantial modifications of today's engines.

At this time, none of the synfuels except gasohol has yet entered the commercial stage. As prices for natural petroleum continue to rise, though, and as the production technologies evolve, synthetic petroleum could rapidly become competitive. The federal government seems determined to help develop the technology and raise the capital needed to build production plants. But the lead times for these plants—on the order of 5 to 15 years—will keep synfuels from easing any immediate energy crises.

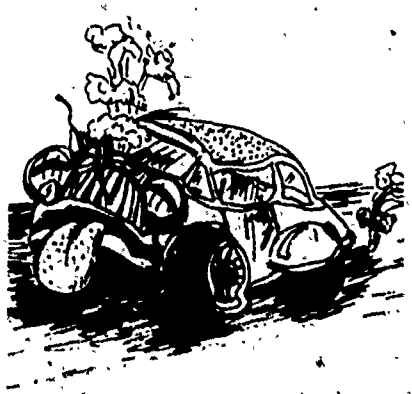
A domestic synfuel industry would also create some serious environmental problems. Synthetic petroleum plants would churn through enormous quantities of coal and shale oil, and disposing of the spent shale and coal by-products would be a costly and environmentally difficult task. Producing synfuels, moreover, requires enormous quantities of water, a resource in short supply in the western United States, where most of America's shale oil and coal is found.

Finally, producing and using synthetic fuels releases into the atmosphere from 1½ to 3 times more carbon dioxide than burning natural fossil fuels does. Many scientists fear that if the present buildup of carbon dioxide in the atmosphere continues, it could trigger a global warming trend. If temperatures do begin to rise, and experts expect to know whether they will by sometime around the turn of the century, countries throughout the world will have to curtail much more than just the use of automobiles.

To avoid some of the environmental problems of synthetic petroleum, cars in the future may run on any of a number of new fuels and engines. Pure alcohols, which can be produced either from biomass or from gaseous fossil fuels, are one promising possibility. Although they would require modifications of today's engine, they offer greater energy efficiency, generally reduced emissions, and tremendous versatility of production. Along with synthetic petroleum, they stand as the best candidates to begin replacing natural gasoline sometime during the 1980s.

Electric vehicles are another possibility. The low power densities of today's batteries now limit the range and performance of electric cars. But the federal government has thrown its backing to the technology and hopes to have thousands of electric vehicles on the roads for testing and demonstration in the next few years.

Perhaps the ideal automotive fuel, but technically the most distant, is hydrogen. Burned with oxygen, it releases high amounts of energy with essentially no harmful emissions. But storing hydrogen, both during distribution and in cars, presents tremendous difficulties. And no one has yet invented an inexpensive way of extracting hydrogen from water.



Gasoline and the American Way of Life

Many of the immediate consequences of a gasoline shortage are now painfully apparent to most Americans. The gas crunch of 1979 jolted millions of Americans out of their daily routines, cost them millions of dollars, and may have permanently changed the way many people lead their everyday lives. Tighter gas supplies may be the rule in the years ahead—certainly higher gas prices will—and even if another severe shortage does not occur, changes caused by tighter gas supplies and higher prices may well be woven into the fabric of American society.

The gas crunch of 1979 brought gas lines over three miles long, odd-even rationing plans, and maximum and minimum limits on gas sales. Owners of gasoline stations were forced to curtail hours, lay off employees, turn away thousands of desperate motorists, and break up all-too-common gas line fist fights. Some gas station employees even found themselves pumping gas at gunpoint or recuperating in the hospital after having been assaulted.

America's $110-billion-a-year vacation industry suffered because many people would not take long trips without being sure of getting an adequate supply of gas. Roadside restaurants, and in fact restaurants of all kinds, endured a loss of business. Small businesses that depend on deliveries, such as florists and pharmacies, had to pay their employees to wait in gas lines. And plumbers and electricians lost money on higher gas prices, lost more money by paying employees to wait in gas lines, and lost still more money by missing opportunities to do more business.

What do the effects of the gasoline shortage of 1979 suggest for the 1980s? In general terms, a long period of readjustment probably lies ahead, more painful for some than others, and more or less severe depending on the price and availability of gasoline. Higher gas prices mean higher food and clothing prices, since roughly 80% of all foods and fabrics are shipped by truck. Tight gas supplies could mean curtailing outreach programs for senior citizens, the handicapped, and the rural poor, since fewer volunteers will be willing to drive long distances. Employment among the poor could also suffer if gas supplies are tight in the years ahead, because the cost of looking for a job and traveling to distant workplaces will cut into already overburdened incomes.

Changes for Better and Worse

Although scarce supplies of gasoline harm the majority of people, some businesses may prosper under such conditions. Bicycle and motorcycle manufacturers could have some good years ahead. Mass transit companies will probably get both new customers and additional funds to help expand their services. Neighborhood stores could enjoy a comeback as people try to conserve gas by driving fewer miles. More backyard swimming pools may be built as people try to relax in the water without having to drive to it. In the recent gas crunch, bowling alleys and local movie theaters enjoyed new popularity, and in the next decade, local businesses of all sorts could enjoy a renaissance as more people try to stay closer to home.

Staying closer to home, in fact, may become much more common in the future. Modern telecommunications make shopping by phone possible, and more and more workers may use computer terminals in their homes to avoid the expense of driving to work. People may well increase the freezer space and storage capacity of their homes so they can stock up on frozen and canned foods to save trips to the supermarket. Cable television, videocassette recorders, and electronic games could enjoy even greater popularity as alternatives to entertainment away from home. People may also watch more television and read more than they do today.

But even though some areas of the economy may benefit, a decade of scarce and costly gasoline will bring painful dislocations to many economic sectors. State and federal governments will lose gasoline tax revenues, which may hamper road repairs and make driving even less appealing. Sales of camping, hunting, fishing, and skiing equipment may fall off, and power boats may have a hard time selling. A further decline in tourism may well occur, and ski resorts, many of which are hundreds of miles from major metropolitan areas, could be particularly hard hit. Sales of recreational vehicles may continue to slump. It's even possible that some policemen may return to walking their beats, or that some states may raise the driving age to discourage teenage driving.

In broader terms, what continued gasoline shortages could cost Americans is one of their most prized freedoms—mobility. And this loss of mobility will mean that people's decisions about how to spend their time and money will be both more difficult and more important. Working women, for example, could be put in a double bind by increasing demands on their time: the need to cut expenses by preparing more home-cooked meals, raising gardens, or taking care of the children at home could easily clash with the growing need for a second income.

These kinds of decisions may mean that the 1980s will be a decade where cooperation—between gas station owners and motorists, retailers and customers, governments and businesses, and husbands and wives—may be more important than ever. But in a century where mobility and the independence it brings have been increasing almost decade by decade, the partial loss of that mobility is likely to breed frustrations that will make cooperation difficult.

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DILEMMA 4: "Fuel for Our Cars — The Synfuel Battle"

Despite their years of effort, the residents of Cane County were unsuccessful in stopping the proposed synthetic fuel plant. Cane County, dotted with wheat farms and ranches, was selected because underneath its surface lies a rich store of over two billion tons of coal. The coal would be mined and brought to a huge plant that stretches over 100 acres. At the plant the coal would be liquified into diesel fuel — over 30,000 barrels each day.

To the residents this new development meant an end to their quiet, peaceful farming and ranching life. Although they objected to the plant because it would bring in more people, they were more fearful of the pollution. Converting coal to synfuel produces sulfur dioxide. Small amounts of sulfur dioxide in the air would affect the growth of the winter wheat. Smaller wheat harvests would put the farmers out of business. Also, the land, once mined, might never be restored to rich farmlands again.

Jim Brown, a farmer, felt that the residents, if they really wanted the plant stopped, should begin to talk about some more drastic tactics. All their talk with lawmakers, government agencies, and lawyers had merely postponed the building of the plant. Now the plant was approved. Like residents in a neighboring state who objected to the construction of power lines, they should now consider using physical force to stop the plant. This would include damaging the building equipment, trucks, the railroads, etc.

Should the residents of Cane County take such drastic actions? Why or why not?

DISCUSSION QUESTIONS

- Do the residents have any other choice but to take drastic action? Why or why not?
- Shouldn't the residents consider the importance of fuel to the rest of the country? Why or why not?
- What should be more important to the government — fuel oil for heating and running cars or the protection of farmlands? Why?
- Do the residents have a right to decide what should or should not be built in their area? Should a small number of people have the right to go against the President's decision to produce needed synfuels?
- Is it ever right to damage property of others? Why or why not?
- Since the President proposed the development of synfuels (so that our country will depend less on imported oil) should every citizen support the effort? Why or why not?
- How might increased sulfur dioxide pollution affect the rest of the country?
- Should we consider other ways of reducing our use of fuel so we need not develop synthetic fuels that will add to air pollution?

ACTIVITY 4: Class Survey: Your Views on Mass Transit

The results of this activity will provide information for Activity 5. The activity may be completed simply with the members of this class. Alternatively, each class member may survey two or more students in the school or people in the community. The purpose is to determine the extent people use mass transit and their opinions about the system.

Instructions

- Your teacher will distribute copies of the *Mass Transit Survey Form,* Handout 3, for you to complete. Answer the questions as completely as possible.
- If you conduct the survey outside the class,
  - Try to interview persons who live in different parts of the community.
  - Explain to your interviewee the purpose of the survey. Make sure that you have sufficient time to complete the interview and that you will not be interrupted frequently.
  - Try to get your interviewees to explain their answers and to openly express their opinions. It is, therefore, important that the person feel relaxed and unhurried.
  - Complete the survey and return the forms to the survey supervisor (teacher or student).
  - **Tabulating the Results.** Each question will be tallied and the results will be summarized. On open ended questions the usefulness of your data, to a large extent, will depend upon the way the responses are organized and tallied. How you present the results affects the conclusions that one makes.

For example, if the responses to the question "How far do you travel on mass transit?" were as follows:

1 mile	1	9 miles	2
2 miles	4	10 miles	3
3 miles	8	12 miles	2
4 miles	7	13 miles	1
5 miles	4	14 miles	1
6 miles	4	18 miles	1
7 miles	3	19 miles	1
8 miles	2	21 miles	1

How would you best summarize the data?

If you tallied the answers in the following two categories, these are your results:

1 to 20 miles = 44 responses
over 20 miles = 1 response

Based on these responses one could say that most people travel under 20 miles on the mass transit system. This statement is true, but it does not give a very specific picture of the situation. One could also present every single response but such a listing makes it difficult for the reader to draw conclusions.

Look at the raw data again, and try to determine where the responses cluster or the general trend. Most riders seem to travel 5 miles and under. One might set up three categories and summarize the data as follows:

1 to 5 miles = 24
6 to 10 miles = 14
over 10 miles = 7

From this summary one would conclude that over half the riders travel 5 miles and under. Some travel between 5 and 10 miles and a few travel over 10 miles. In this case, most riders are short distance riders. Using the first method of setting up the categories, one gets the impression that most people travel longer distances — anywhere between 1 and 20 miles.

If you care to do some additional math, you could find out the average distance travelled. The average number of miles is determined by multiplying the number of miles by the number of responses. The products are added and the total is divided by the number of responses:

1 mile × 1 = 1
2 miles × 4 = 8
3 miles × 8 = 24
4 miles × 7 = 28
total = 61

There were 20 responses, so 61 is divided by 20

$$\frac{61}{20} = 3.05 \text{ miles average*}$$

**In this example we used only part of the data, just to show how the calculations were made.*

However, if you do not wish to work out the statistics, summarizing the results into categories will be sufficient.

For the questions that are answered by statements it is recommended that you first read over all the answers to obtain a general impression of the different types of responses. Then set up the categories based upon your readings of the responses. For example, responses such as:

"No, I don't ride buses because they don't run often enough."

"No, because I have to wait too long before a bus comes."

can fit into the category

"Infrequent service."

In summarizing a question such as Question 8, "Do you think that the mass transit system in your community is adequate and convenient to use?" you would total the number of "yes" and "no" responses and then list the types (categories) of reasons people

give for liking or disliking the system and the number of people giving those reasons.

- **Class Procedure.** If there are a large number of survey forms to be tallied, the entire class should work together on the scoring.
  - — Form small group of 3 to 4 members.
  - — Each group will be responsible for a set of questions. For example,

    Group 1 will work on questions 1 through 5
    Group 2 will work on questions 6 through 9
    Group 3 will work on questions 10 through 12
  - — Distribute the survey questionnaires equally among the student groups. Each group will tally the responses from the questions assigned to it. When a group has finished with its set, it will exchange that set with a set from another group. Do this until all responses from the survey forms have been recorded. (To be sure that you have not missed a form or counted a form twice, use some type of check mark to show that the response has been recorded.)
  - — A *Summary Survey Form* will be posted in the classroom. (This is an unused copy of the Survey Form.) Each group will record its results on this form.
  - — When all survey questionnaires have been counted and summarized, a member from each group will report its results to the class. The results should be presented in the order the questions appear.

DISCUSSION QUESTIONS

- From the results of your survey, what conclusions can you draw about the importance of mass transit in your community?
- What types of mass transit are available in the community?
- What seems to be the major assets of your community's mass transit system? Major disadvantages?
- If there is little or no mass transit in your community, do you think that it is needed? How might mass transit serve the community?

Mass Transit Survey Form

1. How many times a month do you use mass transit? _____
2. What type of mass transit do you use? (subway, bus, trolley, train, cable car, monorail) _____
3. Approximately how far do you go? _____
4. What is the furthest distance you travel on mass transit? _____
5. For what reason do you use mass transit? (work, school, shopping, pleasure, etc.) _____
6. How far from your home is the nearest mass transit stop or station? _____
7. Do your parents use mass transit regularly? (circle one) Yes No

   Why or why not? _____

   _____
8. Do you think that the mass transit system in your community is adequate and convenient to use? (circle one) Yes No

   Why or why not? _____

   _____
9. If the mass transit system in your community provided more services, do you think that you will use it more often? (circle one) Yes No

   Why or why not? _____

   _____
10. If you do not use mass transit in your community, please explain the reason.

    _____

    _____
11. Do you think that the mass transit system in your community is used to capacity? Explain.

    _____

    _____
12. How can the mass transit system attract more riders? _____

    _____

Reading 5

MASS TRANSIT

Have you ever walked for blocks, then stood shivering in the cold waiting for a bus? Or looked out the window of a dirty, noisy, crowded train and watched with envy as others rode by in the privacy and comfort of an automobile?

To solve these problems, cities and the federal government are spending billions on new mass transit systems. They have bought and built computer-operated electric trains, buses that bend in the middle, and "super" trolleys. Even so, not nearly as many people have left their cars at home as planners had hoped. Without commuters to pay fares, rapid transit systems lose money by the carload. In 1976, the U.S., state and local governments spent $1,790,000,000 to make up the difference between what it cost to run the systems and the money they brought in. The deficit was expected to be even greater in 1978.

The problems began after World War II. Governments neglected mass transit systems in favor of new highways. Automobiles offered convenience, privacy, comfort, flexibility, security and prestige. Most people who could do so chose this way to go. However, this led to bumper-to-bumper congestion, increased air pollution, and energy shortages.

Congress began taking action to upgrade transit systems in the 1960s. It established grants to improve and expand urban mass transit lines in 1964. The Federal Aid Highway Act of 1970 authorized money to be taken away from highway projects and used in this way. In 1974, the federal government began giving subsidies to make up the difference between what it cost to run a transit system and the dollars it earned.

This turned out to be an expensive non-solution. The cost of building and operating mass transit facilities soared, while riders decreased. In the years from 1950 to 1970, the average cost per passenger jumped more than 200 percent. The cost of employees to run the trains and buses rose at an even greater rate. But ridership and revenue dropped steadily until 1973, the year the Arab nations cut off supplies of oil from their countries to ours. When the oil flowed again, prices climbed sharply. The high cost of driving and operating a car, and installation of new transit systems, took more and more people and their automobiles off the road in 1974, 1975 and 1976. City buses and trains throughout the U.S. carried more than five billion passengers in 1976. But ridership began to level off in 1977 and the future remains uncertain.

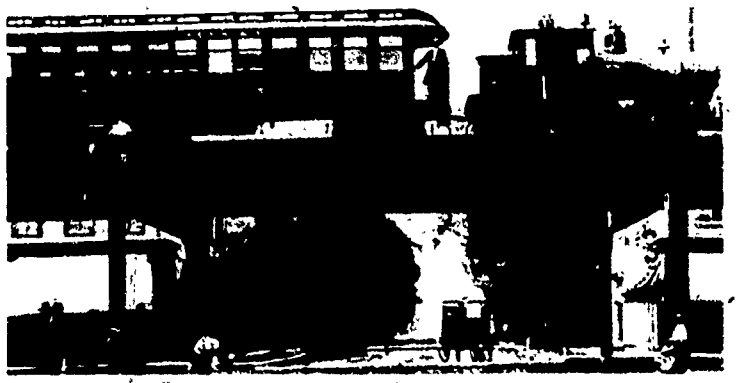

Photo: Courtesy of Chicago Transit Authority

The first major modern transit system started service in 1972. Called the San Francisco Bay Area Rapid Transit, or BART, it carries people over 71 miles of track in high-speed, computer-run electric trains. BART, built at a cost of $1,400,000,000, was hailed by some experts as "setting a pace for future mass transit systems." It did. The line, and others that followed, have been plagued with failures, accidents, and criticism.

Stories of the BART trains not stopping to pick up passengers, of doors not opening, and of failures to let people off at the right stations, abound. Nevertheless, BART now carries about 125,000 riders a day, 35 percent of whom used to drive cars to and from work. *This has produced a notable reduction in highway congestion.*

The newest system to be built carries passengers in the Washington, D.C., area. Called the Metro, this fast, quiet subway-and elevated train was partially paid for by $287,000,000 taken from interstate highway trust funds. Originally estimated to cost $2.5 billion, the price tag rose to $4.7 billion before the first line opened in 1976. By mid-1978, only 18 miles of the planned 100 miles had been completed. The federal government ordered a restudy of the project and announced that costs beyond $4.7 billion would have to come from local sources.

Bay Area Rapid Transit

Experience with BART and Metro led experts to rethink the whole business of mass transit. In the early 1970s, engineers envisioned people whizzing along at speeds of hundreds of miles an hour on vehicles guided by monorails, cushions of air, and magnetic fields. Today, such new technology appears to be losing out to upgrading existing bus and rail systems.

Upgrading takes various forms. Highways that lead in and out of Los Angeles, Washington, D.C., New York City and other areas contain lanes reserved for buses and car pool vehicles. On the Santa Monica Freeway in Los Angeles, riders in comfortable buses zoom right by slow-moving lines of bumper-to-bumper traffic. In Seattle and other cities, buses bend in the middle and do not produce as much congestion when turning at busy intersections. Other transit systems offer low fares and special services to attract riders. On Sunday, in Chicago, people can ride trains and buses all day for 80 cents and take a "culture bus" that stops at many points of interest in the city. "Dial-a-ride" systems use minibuses that provide door-to-door transport. Many cities now have special transit police and have beefed up security on vehicles and in stations.

Instead of large, costly systems such as Metro, attention is now focused on so-called light-rail transit. Transportation planner Arnim H. Meyburg of Cornell University describes this as "the old-fashioned trolley or streetcar modernized and given a new name."

The Urban Mass Transportation Administration (UMTA) committed $269,000,000 to pay for a "souped-up" trolley system in Buffalo, New York. This was the first light-rail project approved by the agency under a new policy of encouraging cities to develop less costly types of transit lines. UMTA also announced that it would finance small, automatically controlled "people mover" systems in Cleveland, Houston, Los Angeles, and St. Paul. Such vehicles have been compared to horizontally moving automatic elevators. Small cars run on guideways, starting and stopping at the press of a button. The agency also helps people to pay for buses of advanced design. On the drawing boards are plans for buses with low floors, ramps, and lifts to aid the elderly and handicapped.

Many transportation planners no longer believe that increased use of mass transit automatically eases energy and pollution problems. Some of them argue that systems such as BART use more energy than improved highways which permit an increased flow of traffic.

The Office of Technology Assessment (OTA) concludes that doubling the miles traveled by mass transit vehicles would increase ridership only 20% to 40%. According to OTA studies, rapid transit lines, trolleys and buses are energy-efficient only if they carry a large number of people on each trip. But the studies found that increasing service usually results in fewer riders per trip. Thus, if doubling transit mileage only increased ridership 20% to 40%, energy use and pollution would increase for each mile traveled by a passenger.

Meyburg believes that most people will continue to rely on automobiles no matter how expensive or wasteful they may be. Mass transit will capture riders only as costs of auto travel become too high, and public systems provide more comfortable, convenient and flexible alternatives, he says. He also believes government help for mass transit systems is here to stay. "Recent developments have led to the new idea of public transit as public service rather than profit-making business," Meyburg comments. The systems are profitable only in situations that do not meet all the mobility requirements of the public. To get people where they need to go will require funds from taxes and fees collected by all levels of government.

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Current Energy & Ecology, January 1979, pp. 24-25

ACTIVITY 5: Plans for a Mass Transit System

We know that if we keep more cars off the road, air pollution, traffic congestion, noise, and fuel consumption will be reduced. In many towns and cities mass transit systems are an important alternative to the private automobile. They also serve those who do not own cars or are unable to drive. As the price of fuel rises, fuel becomes scarce, and the cost of operating cars increases, we will see an increased need for mass transit. In this activity you are asked to develop a plan for a new mass transit system in your community.

Instructions

- You will work in small groups of 3 to 4 members. Each group will develop its own mass transit plan.
- The plan will be a short written proposal which includes a description and explanation of the plan and a discussion of the benefits. It might also include sketches of the vehicles, routes of the system or map showing the different sections of the community to be served.
- Use Handout 4 to help you organize your ideas.
- Each group will then present its proposed plan to the entire class. The presentation should be limited to approximately 10 minutes in length. All members of the group should participate in the presentation.
- After presentations of the proposals, discuss the advantages and disadvantages of each of the plans. Which of the plans is best suited for your community? Would a combination of several plans work better?
- Before you develop your proposal consider the following questions and suggestions.
  - If your town or city is large, you might develop a plan for just one section.
  - Investigate new "advanced" forms of mass transit — such as *personal rapid transit systems, minibuses, monorails, automated subways, street car trains,* etc.
  - Use the results of your survey for clues about the travel habits and needs of your community.
  - Can the present system be modified and improved?
  - How might your proposed system meet the needs of different groups of people? (i.e., senior citizens, students, physically handicapped)
  - Are all major areas connected by the mass transit system?
  - An entirely new system can be very costly. How might funds be obtained for installing the system?
  - What strategies can you use to convince people to use mass transit more often?
  - How will your proposed system save energy?
  - Will different sections of the town need different types of systems? That is, are some systems better suited to the business section? Residential section?
  - How important are sheltered areas for people when they are waiting?

MASS TRANSPORTATION

Current Systems	Sections of City Serviced	Proposed New Types	Sections of City Serviced	List Benefits of New Proposed System — compared to current system

SECTION II:
Water Transportation

In this section we will examine transportation by water. Water crafts come in all sizes, from huge luxury ocean liners to small, two-oar rowboats. Each type is designed for different purposes. Some carry cargo, some carry passengers, some are sea going factories, such as fishing boats where fish are cleaned, cut up, packaged and frozen. Others are purely for sport.

Many boats and ships are engine powered and thus burn fossil fuels. Moreover, a significant portion of them are pleasure crafts. The modern luxury ocean liners consume enormous amounts of fuel to take vacationers on long cruises. Add to this amount of fuel the millions of gallons of fuel used by the small craft owners boating across our oceans, rivers and lakes, and one can begin to understand the vast amounts of fuel being used for pleasure boating in the United States. Many of the issues arising from boating deal with the question of fuel usage.

Given our current energy shortage, can our country continue its present large fuel consumption for pleasure boating?

Should there be a limit to the amount of fuel one can use? Should fuel be used only for "necessary" travel?

The answers to these questions and questions similar to these are not easy. The question of how to use fuel most beneficially is a modern social problem. One fact is certain: the United States depends on large quantities of fuel to satisfy its energy appetite, and this fuel comes from oil. The United States is, however, dependent on importing oil from foreign countries. The United States cannot meet all its oil needs if it depends only on oil from its own wells. We must rely on importing the additional amount of oil from foreign nations. Importing oil also presents another type of problem — the transportation of the oil. The current and most popular way is using the supertanker or VLCC (very large crude carriers). These tankers carry hundreds of thousands of tons of needed oil across the ocean. Because of their enormous capacity, these ships are truly a sophisticated feat of engineering. While these ships are a remarkable accomplishment, they have introduced a new threat to both the ocean environment and people.

The following readings and activities deal with the supertanker. The articles will introduce you to the ship, highlighting its merits and its problems. After reading the article and discussing the question, you might begin to think more critically about the benefits and hazards related to the supertankers. Read the following articles and contribute any additional information you may have on the topic.

Reading 6

Superships, Superhazards

By Jim Hampton

WHOEVER thought up the cliche "You can't tell a book by its cover" must surely have had *Supership* in mind. Author Noel Mostert, a Canadian journalist and native South African, has written a book whose unexciting, unrevealing title conceals all but a hint that it is possibly the most significant, frightening book of its kind since Rachel Carson's *Silent Spring*.

Supership is about oil tankers, ships so big they're no longer called ships but VLCCs or ULCCs—for Very (or Ultra) Large Crude Carriers. Right now hundreds of them are plying the oceans between the Persian Gulf oil depots and the petroleum-dependent energy gluttons: America, Europe, Japan. Laden to their Plimsoll marks with 200,000 to 500,000-plus tons of oil each, they represent profits of up to $4 million per voyage for their owners, immense economic power to the Arabs whose oil fills them, heat and light and Sunday drives and plastic gewgaws to the nations that rely on them, and the potential for inchmeal ecological disaster for the entire world.

What pesticides represented to Rachel Carson's era, oil represents to ours. Its promise of bounty today outglitters its portents of emptiness tomorrow. And what *Silent Spring* said about pesticides, *Supership* says about tankers: Stop. Think. Weigh the hidden, inescapable costs against the fleeting, questionable benefits. Halt the damage before it becomes irreversible.

Supertankers are one of man's supreme (or most arrogant) engineering feats. Imagine a ship 1,200 feet long, a football field wide, with each of its tanks capable of holding the largest cathedral in Europe—and with its bottom routinely clearing the granite sea bed of the Strait of Malacca (the main route to Japan) or the English Channel's sandy bottom by less than *three* feet.

Such size, such potentially polluting cargos, such close sea bed clearances demand the best design, construction, navigation and propulsion equipment, and seamanship. Mostert offers sobering evidence that what supertankers represent is not the best in any of these categories, but a clear and present danger. He tells a story of greed, incompetence, carelessness, and corner cutting that amount to international lunacy.

Example: When one of Aristotle Onassis' tankers, the Arrow, ran aground in Chedabucto Bay, Canada, in 1970, it polluted the water and shore line with oil. The Canadian board of inquiry found that the officer on watch had no license, nobody else could navigate except the captain, "and there are even doubts about his ability." Moreover, the board found, the Arrow's compass had a permanent error of three degrees, the echo sounder (used to determine water depth) hadn't worked in two months, and the radar had quit an hour before the grounding.

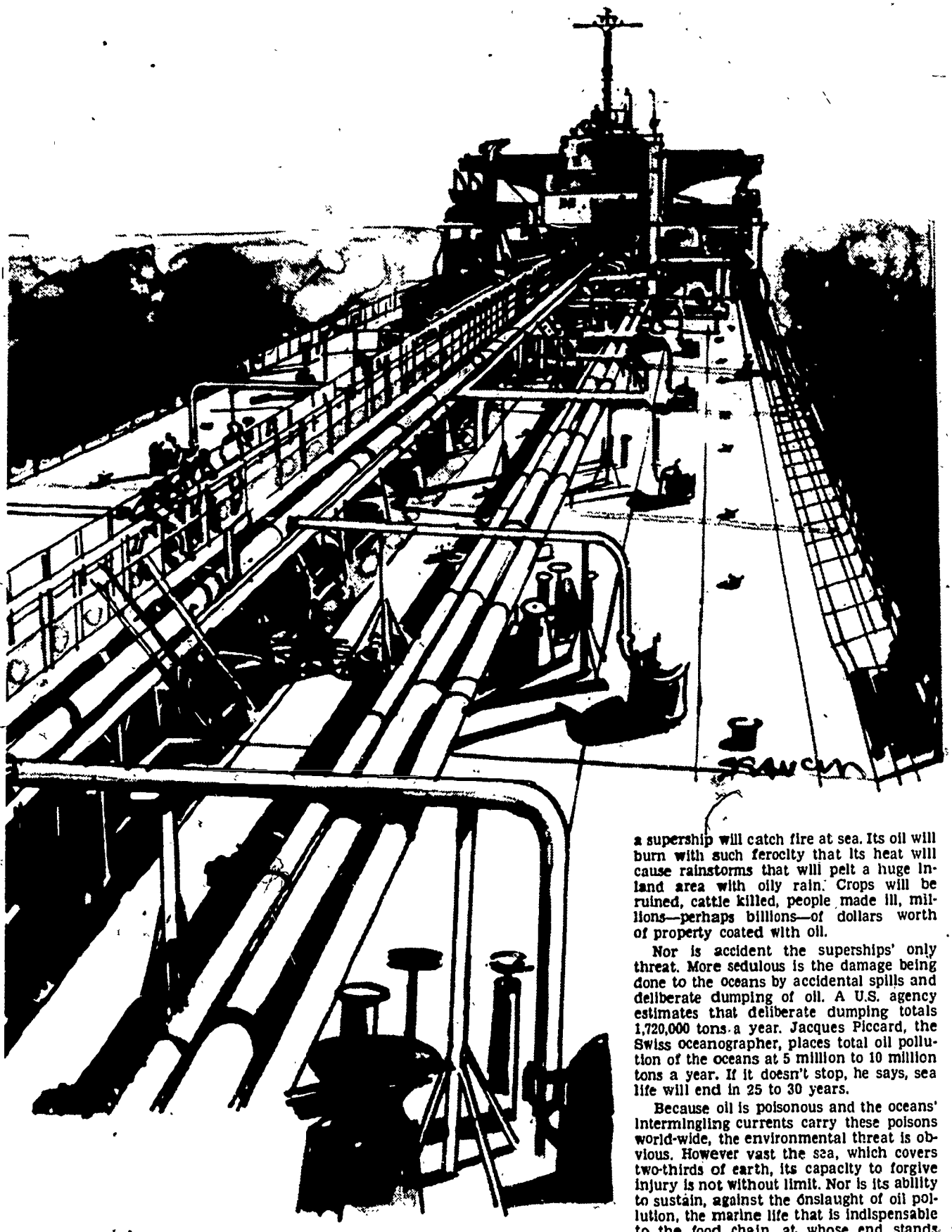
This is only one—and not the worst—of dozens of examples from countless mishaps Mostert cites. In the first four months of 1974 alone, tankers were involved in 226 "casualties" that included "18 tankers disabled by fires and explosions, 20 which suffered weather damage, 20 which stranded, and 15 involved in collisions." As the Canadian board of inquiry said after the Arrow mishap: "The standard of operation of the world's tanker fleets . . . is so appalling and so far from the safety which science, engineering, and technology can bring to those who care, that the people of the world should demand immediate action."

The people of the world are demanding not action but more oil. Which means more supertankers: 388 afloat when 1974 began, another 493—including 26 of 400,000-plus tons—under construction or on order.

The bigness logic is simple. A 300,000-ton tanker is far cheaper to build and operate than three 100,000-tonners. The bigger the ship, the bigger its profits per voyage. But increasing bigness carries with it increasing danger—especially around the Cape of Good Hope, whose churning seas are among the most feared in the world. Hardly a month passes without word of some supertanker spilling oil in Cape waters after it lost power, cracked its hull, or just plain sank.

Small wonder. Mariners historically have been slow to accept innovations, because unproved "better" equipment might cost them their ship, their cargo, and their lives. Superships are all innovation, and Mostert—who sailed on one from France to the Persian Gulf as part of his research—makes clear that the innovation has rarely meant betterment. Most of it has been in line with the tanker operators' unspoken motto, "Build 'em Fast, Build 'em Cheap, Use 'em 10 Years, Write 'em Off."

So what? So the older supertankers are nearing the end of their 10-year write-off lives. The future, Mostert says, is predictable: The worn-out superships, many of them questionable even when new, will pass to new owners possessed of more greed than scruples. As long as they can get crews willing to board them, the new owners will sail these floating pollutants until



the inevitable disaster comes. It's merely a matter of time until one of them goes aground in a winter storm off the coast of Maine, blackens mile upon mile of coastline, kills the marine life, and ruins harbors.

Or, as happened off Spain a while back, a supership will catch fire at sea. Its oil will burn with such ferocity that its heat will cause rainstorms that will pelt a huge inland area with oily rain. Crops will be ruined, cattle killed, people made ill, millions—perhaps billions—of dollars worth of property coated with oil.

Nor is accident the superships' only threat. More sedulous is the damage being done to the oceans by accidental spills and deliberate dumping of oil. A U.S. agency estimates that deliberate dumping totals 1,720,000 tons a year. Jacques Piccard, the Swiss oceanographer, places total oil pollution of the oceans at 5 million to 10 million tons a year. If it doesn't stop, he says, sea life will end in 25 to 30 years.

Because oil is poisonous and the oceans' intermingling currents carry these poisons world-wide, the environmental threat is obvious. However vast the sea, which covers two-thirds of earth, its capacity to forgive injury is not without limit. Nor is its ability to sustain, against the onslaught of oil pollution, the marine life that is indispensable to the food chain, at whose end stands man. If man persists in carelessly handling and gluttonously consuming oil, that chain will surely become a noose.

Mostert is sending us all an SOS. Is anybody listening?

[*Supership*. By Noel Mostert. Knopf. 332 pages. $8.95.]

Reading 7

Supertankers and the Law of the Sea

On Wednesday, May 12, the Spanish tanker Urquiola *went aground and exploded off the northwest coast of Spain near the town of La Coruna, a prosperous fishing and resort community. The ship was carrying 110,000 tons of crude oil from the Persian Gulf. Oil is spilling from the ship, contaminating shellfish beds and spreading a black film over the coastal waters and resort beaches. The local fishing industry employs 6,000 people, and according to a CBS news report, seafood sales began to drop only days after the spill. By contaminating the fishing grounds and fouling local beaches, one medium-sized tanker has probably ruined, at least for a time, the two resources on which the local economy depends. Very little has been done since the spill to clean up the mess. [The Editor.]*

NOEL MOSTERT

ALTHOUGH the international oil-tanker industry is now fighting its worst economic crisis, with hundreds of ships laid up in different parts of the world, the unhappy fact is that tanker losses for 1975 may prove to have been the highest on record, once final figures are in. This year, 1976, began with the dramatic loss of two ships of more than 200,000 tons, and if this rate of disaster continues, 1977 will be even worse.

At this moment, the 280,000-ton Onassis supertanker *Olympic Bravery* lies disintegrating on the French side of the English Channel. Fortunately, she was empty when she went aground a few months ago, but it's no use offering that fact as consolation to those living along the coasts near the wreck; for the bunker oil *Olympic Bravery* carried already has fouled miles of beach and destroyed thousands of sea creatures. What if she had been fully laden? By the grace of our own good fortune, only one serious accident so far has involved a full cargo of oil. That was the 206,000-ton Shell tanker *Metula*, which went aground in 1974 in the Magellan Strait in one of the world's richest marine-life areas. The remoteness of the area saved the ship from the publicity it deserved. No attempt was made to clean up the enormous amount of oil that went ashore, and, according to United States experts who investigated the pollution, it will remain lodged on the beaches and in the inlets for perhaps another ten years, continuously affecting life.

It is against this background that we must consider the environmental risks of big tankers and the legal means of ensuring that they do as little damage as possible. The economic plight of the tanker owners does not mean relief from the problem of pollution. Far from it. It means that the dangers are immensely greater than they have ever been, and that they will increase rapidly from now on. For the world tanker fleet is now dominated by big ships, and these vessels will carry most of the world's oil for years to come. Tanker casualties have always been high, but up to now the accidents have mainly involved smaller ships because these dominated the world tanker fleet. Accidents in the future will happen mainly to big ships because they are the ones we will have. Accidents will be caused by sudden foundering owing to structural failure, engine-room flooding, explosion, or breakdown, which have been among the principal causes of small-ship losses. Accidents are also caused by bad navigation, collision and misjudgment.

Aside from all these conventional hazards, the big ships take us into entirely new areas of risk, which could mean that their accident rate will be even higher than that of smaller tankers. Their explosive risk has proven more unpredictable, they are immensely more difficult to maneuver, and they offer a special danger because of their great draft. They also present a special danger because, unlike smaller ships, they are almost constantly at sea. As a result, their crews suffer greater psychological deterioration, which means that efficiency can be seriously affected.

The head of the Shell Oil tanker fleet (since retired) told me in a tape-recorded statement that his own experience proved that small ships, which move constantly in and out of port, were a smaller risk than big ships, whose long voyages resulted in a decline of efficiency after a certain period. In this regard, big ships are now operating at sometimes half their normal service speed of fourteen knots, prolonging their voyages and creating the depressing effect of hardly moving at all.

Tanker owners are cutting every corner possible in maintenance and operation of their vessels to save what they can and where they can. Not only do they have huge financial burdens imposed by laid-up and unpaid-for ships, but inflation has raised all ship operating costs to very high levels. Therefore we face immediately the problem that hundreds of giant ships laden with immense quantities of oil are operated by seamen who spend more time on board and who are under orders to keep running costs at a minimum.

For the past eighteen months, marine underwriters have been issuing alarmed statements about these conditions and the rising curve of big-ship losses. Anyone who reads the maritime trade papers will know what I mean. In fact, in its issue of March 11, 1976, the leading international shipping weekly, *Fairplay*, carried the first of several articles on very big supertankers and their problems under the headline "Large rewards losing appeal against the big risk."

Fairplay is to the shipping industry what the *Wall Street Journal* is to American business, and the problems it outlined are the very ones which the oil industry and the tanker industry have spent millions of dollars

Noel Mostert is the author of Supership. *The article printed here is adapted from a statement written for the Sierra Club Office of International Environmental Affairs for presentation to the fourth session of the Third UN Conference on the Law of the Sea.*

in denying. I will quote the article extensively because, for once, the oil and shipping industries will have to carry their denials to their own trade press, should they, in this instance, wish to make them.

> The stranding of the 275,000 ton *Olympic Bravery*, together with the recent loss of the 224,000 ton *Berge Istra* has emphasized the high rate of casualty that has been suffered by large vessels in recent years.
>
> Unlike the large passenger vessel, with which they compare in size, the VLCC [Very Large Crude Carrier] has only one deck—its main deck—and below that it relies solely on its internal tank bulkhead construction and shell plating for its strength. Contrasted with the normal operation of the large passenger vessels, the VLCC must be able to meet a monsoon this week and an Atlantic gale the next, subjecting it to severe hogging and sagging, with broad decks subjected to the weight of tremendous quantities of seawater because of low freeboard. Other stresses and strains will occur when a vessel which was empty a few hours before has many thousand tons to lift as rapid loading takes place. At discharge ports, the vessel may only be able to dock at high tide and delays may result in the ship sitting on her bottom plates before the draft can be lightened sufficiently for the available water.
>
> The very structure of the VLCC is controversial. In the early '60's the Japanese, alarmed at the cost of the old-fashioned methods of riveting giant ships, pioneered many of the early constructional techniques of VLCC construction. In October 1972 this led the Japanese Ministry of Transport to censure two of Japan's biggest shipyards (Ishikawajima-Harima and Kawasaki) for negligence in construction. Fifty-five VLCC's were called in for repairs.
>
> Hull underwriters are confronted with entirely new factors of risks when they rate tankers over 200,000 d.w.t. [deadweight tons], perhaps the most serious concerning draft. It seemed that one aspect of operating VLCCs, which had not perhaps received enough attention from the shipping industry, was the fact that the hydrographers had not kept pace with demands.
>
> Other problems are structural weakness which may arise in service, availability of graving docks, adequacy of tugs to handle VLCCs if they run into trouble and an adequate supply of competent masters. Basic underwriting rates are based on deadweight tonnage and on value. Certain repair costs could be roughly pro rata to size—for instance, damage by fire, stranding, grounding, collision, etc.—but a bigger vessel may still have only one propeller, one shaft, one engine, it does not need to be drydocked more frequently, crew's wages do not grow in proportion, nor does the capacity of any necessary tug. On the other hand, plates are thicker and more expensive, bridge equipment more complicated and expensive in a new ship, larger drydocks are less readily available, and everything is bigger and yet just as vulnerable to damage.

It is academic at this point to discuss whether we should or should not have these ships. Certainly every argument to justify them has completely collapsed, and the principal of these is the argument that they help reduce the price of oil. On the contrary, the evidence today is that they probably have increased it, once all economic considerations are taken into account. Aside from the fact that there was no conspicuous reduction of the price of oil when the tanker owners were making conspicuously large profits in 1972/73, the fundamental economic fact of these ships is that their profitability is calculated upon full employment during the life of the ship, a laughable concept these days. As Dr. P. D. McTaggart-Cowan, Executive Director of the Science Council of Canada, who undertook exhaustive studies of these ships and their impact, told me,

> If one includes the external costs, such as the creation of very large and sophisticated new unloading and docking facilities, and makes allowance for other than full employment during the life of a ship, the perceived economies of scale in very big ships have quickly become figments of the imagination of the financiers. Ultimately, the consumer pays. I suggest that this would be the case without any allowance for potential environmental costs.

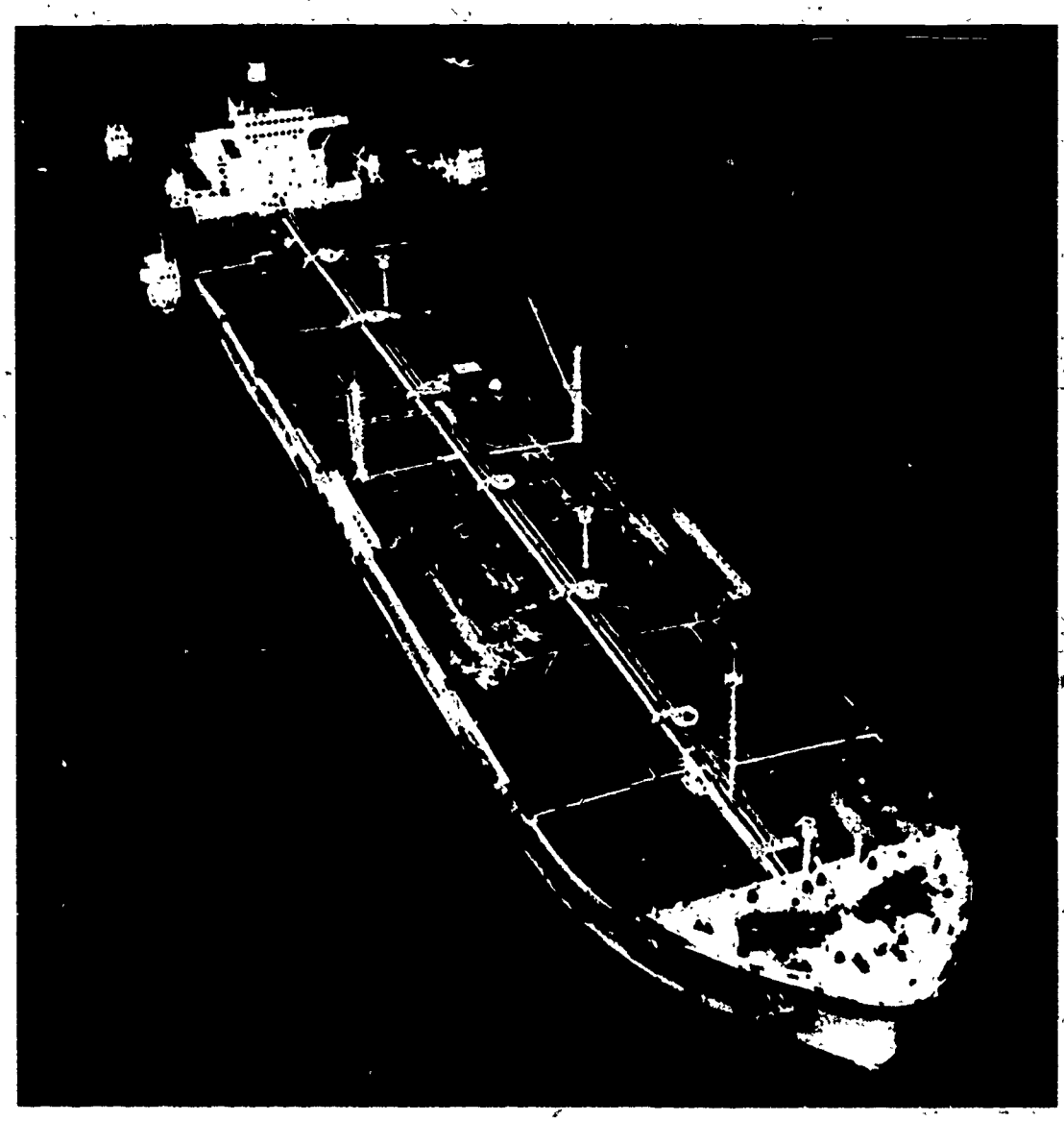
The most exhaustive technical paper on big ships to be published in the United States, "Tankers and the U.S. Energy Situation," which was read to the December 1973 meeting of the Philadelphia section of the Society of Naval Architects and Marine Engineers, declared unequivocally that ". . . adverse environmental effects or the costs of providing off-shore terminal systems could outweigh any transportation savings of large tankers." That paper, incidentally, was wholly in favor of big ships. But, like practically every serious study of the big ships, it made nonsense of the principal argument in their favor.

The point these days is that we are stuck with big ships. They are the ones that we have, that will move the oil and that we must now think about and contend with. What we must also firmly accept is that the oil has to move over the seas, that to imagine we can dispense with oil tankers is ridiculous; they become daily more necessary than ever. Oil consumption remains vast; economic recession in the developed world, in Japan, Europe, and North America especially, has not meant that oil consumption has fallen drastically, but rather that consumption has not increased at the spectacular annual rate it did through the sixties and early seventies.

Shipbuilding boom

The cause of the present slump in the tanker industry lies with those big annual increases in consumption that characterized the sixties. The tanker owners and oil industry believed such increases would go on forever. Tanker owners in the late sixties and early seventies were making so much money, anything from four- to seven-million dollars profit on a voyage, that they began ordering ships at an unprecedented rate. The world entered the biggest shipbuilding boom in its history. In 1973, tanker owners ordered as much tonnage as already existed: that is, they doubled the world's tanker fleets, which already accounted for forty percent of world merchant tonnage. They did so because they were paying for their ships in just a few voyages, but they killed their own golden goose, the tanker market, by smothering it with too many ships. The most generous and conservative estimates within the tanker industry indicate that the surplus of ships will remain until the early 1980s, which means that the tanker owners are going to be in very rough financial water until then.

We are, of course, not so much concerned with the financial health of the international tanker community as we are with the consequences of their folly upon the environment. In 1975, the National Academy of Sciences told us quite clearly why we should be worried about tankers. In a report titled "Petroleum in the Marine Environment," which is by far the most painstaking and comprehensive document of its kind in existence, the Academy estimated that at least 6.1 million tons of oil go into the oceans every year and that the single biggest source is the oil tanker and its operations. I myself consider the Academy's figure to be extremely conservative because it is based on statistics supplied by the oil industry and which I myself question. Nonetheless, it is symptomatic of the sort of mis-



leading public information provided constantly by the tanker industry that, five months after the Academy's report had been published, the industry claimed at a press conference in London that "the hard fact is that the seas are now cleaner of oil than before the mid-sixties." This statement was offered by Mr. Robin Sanders, principal information officer of the P & O Line, which is the largest of Britain's independent tanker owners. Mr. Sanders either didn't know what his own industry knew, which is inexcusable in an information officer, or he didn't know of the existence of the Academy's report, which is equally inexcusable.

The Academy report tells us that tarry masses are appearing in increased quantity in formerly unpolluted areas such as the east coast of Africa, areas of the Mediterranean and many islands in the Indian and Atlantic Oceans; and it tells us that scientific experiments show that these tarry masses originate from the tanks of oil tankers, and from bilge discharges.

Most of the pollution we have suffered so far has been caused by oil tankers washing their tanks with seawater and then flushing that water back into the oceans. But insurance statistics indicate that we are now moving into the era of the giant spill caused by mishaps to very big ships. Both tank discharge and mishap are to a considerable extent the result of bad management and bad shipboard practice, which in turn can be laid to the fact that a majority of tankers are registered under flags of convenience, where the terms of service, seamanship and regulation leave much to be desired, to say the least.

But it is nonsensical to put the entire blame on flags of convenience or to pretend that if they were removed from the oceans the problem would be solved. Obviously it is better to have ships manned by properly trained people and answerable to the maritime laws of Britain, the United States, Japan or Scandinavia. But that is no guarantee that we have moved into a better world. Far from it. The independent owners are mostly nationals of responsible maritime powers, and their fleets are often divided between their own and various flags of convenience. They have served only their own interests, not the public's. They have fought every

measure to make tankers stronger and safer, and they have misled the public at every turn. Even when standards are good, the nature of tanker life, with its boredom and its psychological deterioration, can bring serious hazards. The chief officer aboard the P&O tanker on which I traveled told me that on another ship of the same size the master had ordered him to lay course in the English Channel against the traffic (as a safety measure ships in the Channel and other high-hazard areas move in separate lanes, downbound and upbound). Last November a 250,000-ton Onassis tanker and a British warship collided in the Channel, and the accident caused a serious oilspill. The accident was attributed to misjudgment aboard the Royal Navy ship, whose personnel could scarcely be more highly trained as seamen. When accidents thus happen as a result of the judgment of the most skilled of sailors, all the more reason to demand the absolute maximum in precaution. The independent ship owners, regardless of whether they are under the flags of convenience or not, have, through their repeated attempts to prevent or delay or misrepresent stronger regulations for their ships, long since disqualified themselves for public sympathy. The tanker business would be better off without them.

Larger market share

The oil companies have indicated that they will be taking a larger share of the tanker market in the future: far better to use their own idle tonnage than charter an outsider's. This, I believe, is an excellent trend, if it gets the independents out of the business. The oil companies, with an anxious eye on their public image, are more careful about their ships, and in any event they are more accessible in the event of damage than a flag-of-convenience owner whose ship is locked inside a multitude of legal complications. (Every Onassis ship was at one time a separate company.)

I am not going to deal with the many good laws passed by the International Maritime Consultative Organization (IMCO), which, commendable and necessary, nonetheless are, to all intents and purposes, ineffective because there is no legal means of truly enforcing them on the high seas.

Some strong form of control is desperately needed for the tanker industry, and the opportunity has never been better. There is only one effective means of controlling the pollution and destruction of the seas by tankers, and that is through strong local laws imposed by the states to which they sail. This suggestion has been vigorously opposed by the tanker and shipping industries, and will continue to be. They have always preferred voluntary efforts, but these have never been good enough because they will never spend a penny unless they have to, and, besides, they have resisted every single measure of merit, such as double bottoms, and reduced tank sizes, because these would cost more. Instead, in 1968, they managed through their influence at IMCO to get permission for tankers to load heavier cargoes and to carry full summer loads through the winter zone off the Cape of Good Hope.

The appalling degree of cynicism in the industry can only be judged by another quote from *Fairplay:*

> To shipowners not involved with the desperate problem of employing millions of tons of seemingly unemployable crude carriers the new role of the tanker owner as an enthusiastic exponent of ecology may seem a little bizarre.
>
> After years of pressing for deeper loading, and fiercely resisting all changes that would reduce the carrying capacity of their ships, suddenly all tanker-owners are passionately interested in the environment and are discussing with enthusiasm the advantages of double bottoms, segregated ballast and redrawn load lines that will hopefully use up some of the huge surplus of unwanted tonnage.
>
> Of course, like the oil saving speed limits that were forced upon road users in the wake of the OPEC price increases, subsequently being retained because of the lives that were being saved, the proposed changes to the load line rules and the requirements for segregated ballast will be easy to make but very hard to repeal.
>
> Once these changes are invoked as a safety or oil pollution preventative measure it will be almost impossible to go back to the bad old days of deeper loading and no ballast.
>
> The principal advocate of these measures to "use up" surplus tonnage has been the International Association of Independent Tanker Owners.
>
> (8 January 1976, p. 7)

Nothing I have seen or heard or read in five years of research on tankers conveys more explicitly the appalling double standards of their owners who, through the United Kingdom Chamber of Shipping, denounced at a press conference in London in May, 1975, the idea of double bottoms and praised large tankers generally as among the safest and most reliable craft afloat.

Not only should their every suggestion as quoted by *Fairplay* be accepted, but they should be given a time limit within which to apply them. IMCO is hopeless as a means of applying this, because of the very length of time involved in making legal any of its regulations and, as mentioned earlier, because of the lack of means of proper enforcement.

Meeting standards

Nations should now individually draw up codes that not only embody the aforementioned proposals from the industry itself, but that establish firm rules on standards of tanker operation, crew health and training, service, etc. The Canadians already are establishing such a system. They will use computers to provide available information on ships approaching their ports. If any vessel fails to meet accepted standards, it will either be fined, or refused admission. Only through this national unilateral approach can we hope to start to minimize the pollution caused by tankers. If, through economic recovery, oil imports once more start rising in Europe, Japan and North America, the present high rate of big-ship accidents will certainly increase. No coast can afford the pollution of a major VLCC disaster, but I fear that within the foreseeable future many will.

I am aware that this advocacy of a national unilateral solution might seem contrary to the idea of a universal Law of the Sea. But I advocate it because it is, finally, the only means of enforcing what is really required. Ultimately, IMCO should be given the sort of powers that the United Nations gave the International Civil Aviation Organization (ICAO), which was established by international treaty with a mandate to write its own regulations and forms of compliance. This sort of authority has allowed ICAO to set down the principles of international aviation and have them accepted by every nation on earth, whether they were signatory to them or not. Until such power is a reality for IMCO, and the Law of the Sea should make some initial effort to see that it is, individual nations must set the standards for tankers using their ports. SCB

Courtesy of *Sierra, The Sierra Club Bulletin,* June 1976, pp.13-16.

DISCUSSION QUESTIONS

- What dangers are involved in shipping oil by supertankers?
- Why is there so much concern about these dangers?
- What other ways can we obtain our needed oil? Are there dangers associated with these methods of transportation?
- What are the major advantages of shipping oil by supertankers?
- What types of regulations might help to reduce the dangers of shipping oil by supertankers?
- Do you think that all countries involved in shipping oil will agree on stricter regulations? Why?
- Is it possible for us to reduce the amount of oil we use so that we do not have to bring imported oil by tanker? (Find out how much oil we import. How much oil does the average American use? By what amount do we have to cut back in order to eliminate our oil imports?)
- How might we change our ways in order to reduce our oil consumption?

DILEMMA 5: "Oil in the Sea"

Miguel Vasquez is the captain of the supertanker Magarita. While transporting some 300,000 tons of oil to the United States, the supertanker goes aground off the shore of Spain. The supertanker was overloaded in port and because of this overload, ran aground in the shallow waters.

Vasquez radios the company's owners and tells them of the accident. The owners order Vasquez to dump some 50,000 gallons of oil into the ocean; this should raise the ship enough so that it will float free again. Vasquez, however, realized that the boat is grounded just off the shore of the small fishing village where he was born. He also knows that the villagers are very poor and make their living fishing the seas. The 50,000 gallons of oil he is to drop in the sea would certainly kill all the fish in the area and destroy the livelihood of the villagers. If he disobeys the owner's orders, Vasquez faces the consequence of losing his job.

Should Miguel Vasquez dump the oil? Why or why not?

DISCUSSION QUESTIONS

- As captain of his ship, what should be Miguel's main responsibility? Why?
- What responsibility does Miguel Vasquez have to the owners of the ship? Why?
- Does Miguel have any responsibility to the people of the village? Why?
- Do the owners of the ship have the right to order Miguel to dump the excess oil? Why?
- If oil kills fish and pollutes the ocean, who should be held responsible? Miguel Vasquez? The owner of the ship? The people who use the oil? Why?
- If Miguel Vasquez does not dump the oil there is a great possibility that the ship's hull can be damaged and larger quantities of oil will spill out. Should the possibility of greater damage be important in Miguel Vasquez's decision? Why or why not?
- Oil spills can have long and lasting damaging effects on the water, plant and animal life and property along the coast. Should the offenders be held responsible for the clean-up only or for all the harmful consequences? Why? Is there a way that the cost of all the damages can be determined?
- Should fishermen have the right to expect the ocean to always provide abundant and healthy fish? Why?

INTRODUCTION TO DILEMMA 6

Travel by sea is perhaps the one form of travel where people are most likely to encounter the fierce, destructive forces of nature. Unlike the airplane pilot who does not fly in poor weather conditions or who can fly above a storm, a ship's captain is always at the mercy of the ever-changing sea. Once out at sea, it is not often possible to find safe harbor from the onslaught of a sudden storm. One can be hundreds of miles away from the nearest land. In most cases there is no choice but to wait out the storm and hope that the ship can withstand the enormous forces of waves, wind and water. In the vast expanse of the sea, even the largest supership is infinitely small and fragile and can be tossed about like a flimsy toy by the sea's raging strength.

Throughout the ages, countless stories and books have been written about shipwrecks, storms, ships lost at sea, and so on. Even today when ships are built of steel and equipped with sophisticated machines and radar, shipping accidents and deaths at sea are not uncommon.

Because the forces of the sea are beyond human control and safe refuge is frequently not close at hand, those who sail the seas are keenly aware of its many unexpected dangers and recognize the importance of people coming to aid one another in times of need.

DILEMMA 6: "Stranded at Sea"

"There's a ship in distress on port side," shouted the ship's mate to Captain Townsend, skipper of the tanker *Myra*. Capt. Townsend adjusted his binoculars and saw a small rusty freighter listing dangerously from side to side. As the tanker drew closer to the freighter, he could see that the vessel's deck was crammed full of women, children and the elderly. Messages from the crippled ship told that it had rammed into a coral reef and was rapidly filling with water. The captain was ordering the lifeboats lowered and requested that the *Myra* pick up the passengers.

As the lifeboats were lowered into the water, Capt. Townsend saw that they were overloaded. Water was lapping over the lifeboats' edge. This irresponsible sight enraged him. The people on these boats were refugees from a war torn country who had, for the most part, spent most of their savings to buy passage on the decrepit freighter. The freighter's captain had taken a ship ready to be scrapped and filled it with as many passengers as it could possibly hold. It was probably the ship's last voyage and the number of lifeboats certainly was not adequate for so many people.

Capt. Townsend then remembered the recent order issued by his company. It stated that under no condition was he to pick up refugees from that country. This was because no other nearby country would allow them entry. The nearby countries had taken many of these people in but because of the large number of refugees, they no longer had room in their refugee camps. They had done as much as they could possibly do and could do no more. If Captain Townsend picked up these people, there might be no place for them to land. He might very well end up with a load of passengers going for months from port to port. The *Myra* was not designed for passengers and had stocked enough food and medical supplies only for its small crew. As captain of the *Myra*, Captain Townsend's main responsibility was the safety of his crew, ship and cargo. Under crowded shipboard conditions and in short supply of food, disease could spread rampantly. In addition, Captain knew that if he disobeyed the company's order, he would be fired. He worked for the company for 27 years and would soon retire on a good pension. But if he were to be fired, he would lose the pension benefits as well as encounter problems finding a new job. Yet, Captain Townsend was torn by the sight of the frightened people below, clinging helplessly onto the tossing lifeboats.

Should Capt. Townsend pick up the refugees? Why or why not?

DISCUSSION QUESTIONS:

- Should Captain Townsend be obligated to help the people in distress? Why or why not?
- The safety of the crew, ship and cargo is a ship's captain's first responsibility. Should this be an important consideration for Captain Townsend when he makes his decision? Why or why not?
- If Captain Townsend picked up the shipwrecked survivors, he would be breaking the company's rules. Should he break the rules? Why or why not?
- Is it ever right to break a rule or law? Why or why not?
- Once the people step onboard the *Myra*, their safety and welfare will be the Captain's responsibility. Should the Captain shoulder such a heavy responsibility? Why or why not?
- Since the Captain doesn't own the tanker and its cargo, does he have the right to use what does not belong to him to help others? Why or why not?
- What might happen if no country allows the people to land?
- If Captain Townsend picks up the people, he might lose his job. Should this be an important concern when he makes his decision? Why or why not?
- Why is it important for people to help those in distress?
- If the people are left at sea and drown, should Captain Townsend be blamed? Why or why not?

SECTION III:
Air Transportation

Airplanes today can carry people and cargo thousands of miles in a few short hours. Contrast this speed with that of early flight and one can easily recognize how advances in science and technology have contributed to "shrinking" our world.

Two of the more recent and controversial modes of air transportation will be examined in this next section. They are the Super Sonic Transport and the Space Shuttle. Both of these vehicles represent exciting and dramatic scientific advances. However, along with these advances come other problems.

In the first part of this section, you will read an article describing the SST, and the new types of concerns it has created. Following the article is a simulation which will give you an opportunity to actively participate in a decision-making process. You should read the article carefully in order to gain a clear perspective about the issues. Feel free to do further research on the topic and share this research with other class members. Carefully prepare and develop your arguments and questions for the simulation exercise.

Reading 8

THE CONCORDE: WHO WILL LET IT FLY?

Whether the SST will fly the most profitable routes depends on access to New York

BAC's Lawson: Backing the Concorde for the all-important transatlantic market

Air France's Martin: A disbelief that the U. S will be closed to the Concorde.

Concorde, the world's first supersonic passenger-carrying aircraft, is scheduled to make its maiden commercial flights on Jan. 21. Its initial routes will be from London to Bahrain and from Paris to Rio de Janeiro. More important than this startup of service are the next steps for the commercial SST. Will it be permitted to operate on other routes, most importantly on the heavily traveled ones between Europe and the U. S.? Will any airline buy it beyond the two captive, state-owned customers of its British and French government sponsors, British Airways and Air France? Even the Concorde's most vigorous proponents admit that the future of the aircraft is hazy. And its most vigorous opponents are determined to use every conceivable tactic to prevent or at least delay the spread of supersonic flight.

The question that will be answered in coming months is whether the opponents of supersonic flying can frustrate it sufficiently to kill the 100-seat, 1,350 mph SST before it catches on with the flying public and more airlines decide they must have it. France, more determined than Britain during the Concorde's 13 years of development, is giving the airlines only one year to find routes and prove there is an adequate demand for tickets. After that it will decide with the British whether to go ahead with production of the plane, currently suspended at 16 units.

But whatever they decide, supersonic flying cannot be killed that easily, much as its opponents would like to see it banned forever. Last Dec. 26 the Soviet Union's Tupolev-144, with a handful of Soviet journalists and "aviation specialists" plus a load of mail and cargo, flew from Moscow to remote Alma-Ata in Kazakhstan 1,900 mi. away. The Russians were determined to beat the Concorde into scheduled service, and technically they did. But by Western standards the Tu-144 flights, which are now restricted to mail and cargo for at least six months, are more in the nature of testing. Nevertheless, even if the Concorde program is abandoned, there is little likelihood the Tu-144 one will be.

A critical factor, but not the only one in determining the Concorde's future, will be the U. S. decision on whether to allow the SST at the two airports British Airways and Air France want to serve, New York's John F. Kennedy with four flights a day and Washington's Dulles with two. This week Transportation Secretary William T. Coleman Jr., held day-long hearings preparatory to a decision by Feb. 5. His most likely ruling will be for a six-month trial period.

The anti-Concorde argument

The main argument against the Concorde is that it is noisy, and this was stressed time and again at the hearings. What is at issue is the engine noise, not the explosive sound the plane makes as it cracks the sound barrier at supersonic speeds. Supersonic aircraft create shockwaves that change atmospheric pressure, a phenomenon known as the sonic boom. But since commercial supersonic flights have long been banned above the U. S. this is not the problem.

The Concorde's engines are noisier than the 707s and DC-8s that started the commercial jet age. All jets make two kinds of noise, the screaming whine of rapidly rotating machinery and the roar of hot gas being blown out the tail pipe into slower moving air. As subsonic jet technology has developed, fans have been utilized to speed the air flowing around the outside of the engine to create a more efficient thrust. With the wide-bodied jets a significant amount of power is derived from the fans themselves in a sort of return to propeller technology. And so the wide bodies are quieter than the 707s and DC-8s.

As new aircraft replace old, commercial aviation is becoming quieter, and under mounting political pressure, plans are being discussed to refit older planes with new engines. Into this political and technological environment comes the Concorde with engines that are noisy by comparison. The Concorde's builders, British Aircraft Corp. and Société Nationale Industrielle Aerospatiale (SNIAS), insist that the Concorde need not comply with U. S. aircraft noise rules promulgated in 1969 by the Federal Aviation Administration to fulfill the requirements of Congressional legislation. The law behind the rules specifically excluded SSTs, since at the time the U. S. was

working on its own SST, and Congress recognized that SST engines had to be loud. They must have greater thrust to lift the tremendous weight of all the fuel an SST carries and propel it through the atmosphere faster than the speed of sound. Fans will not work at supersonic speeds and there is no way to refit the Concorde with quieter engines. Thus, it thunders along with a noise level four times louder than a 747.

Nevertheless, there is a widely held sentiment in the U.S. that the Concorde must conform to U.S. rules even though when its design was frozen the U.S. had no rules at all. "To permit SSTs to use American airports and yet not comply with [current rules] would vitiate the aims and objectives of Congress enunciated in these laws," says Senator Birch Bayh (D-Ind.) who adds that allowance of the Concorde would result in a double standard and "would be a retreat from the legislative determination that the public should be protected from excessive airplane noise."

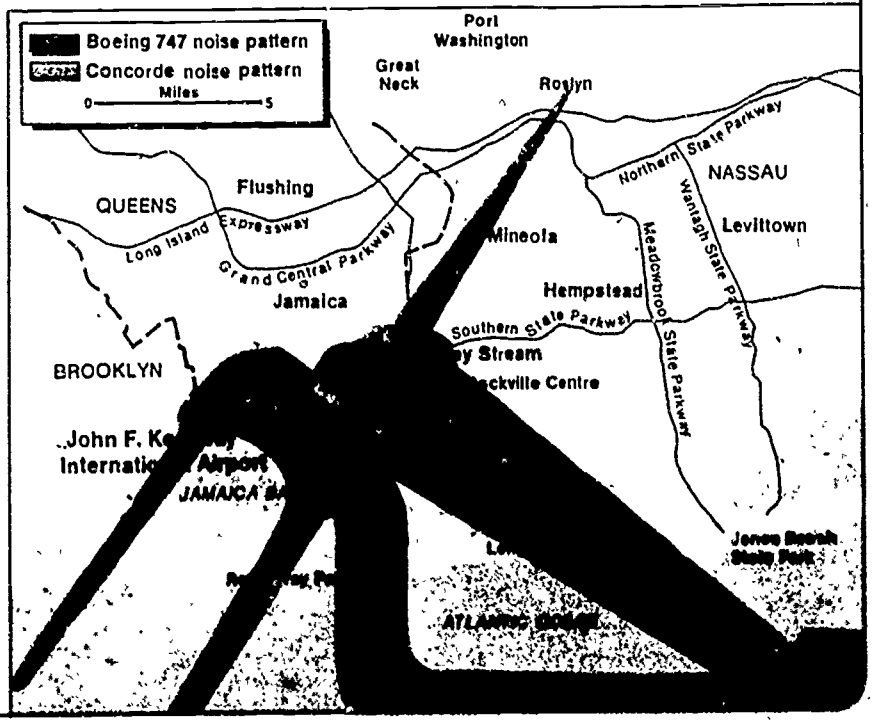
Another element that Coleman must weigh is energy. Can the American public be asked to support a fuel conservation program that includes a 55 mph highway speed limit if the U.S. government allows fast but fuel-inefficient SSTs to "gas up" at U.S. airports, the Federal Energy Administration asks. The FAA's environmental impact statement adds, "Depending on the seating configuration and load factor of the specific airplane, the Concorde would use approximately two to three times as much fuel per seat mile as the subsonic airplanes." And Environmental Protection Administrator Russell Train adds, "At a time of not just environmental concerns and economic concerns but energy concerns, to continue to push a wasteful technology as the Concorde really makes no sense to me whatsoever."

Then there are questions of safety. Can the Concorde be flown to U.S. airports with sufficient fuel reserves for holding in case of air traffic problems? The FAA's Eastern Region, which governs Kennedy operations, says "Concorde is exceptionally fuel critical and special procedures must be set up for delays of more than 30 minutes." Can the Concorde safely execute the steep turns at Kennedy mandated by noise abatement procedures? BAC and SNIAS insist that the Concorde is "the most extensively tested civil aircraft to have entered commercial air service," and that there is no safety problem. Opponents are not so sure. "It's a maneuver which some pilots believe is questionably safe at best," testified John F. Hellegers of the Environmental Defense Fund at the hearings.

Finally, more exotic scientific arguments must be considered: Whether a fleet of SSTs will deplete the atmosphere's ozone layer, thus increasing the incidence of skin cancer, and whether such a fleet would create a layer of gases in the atmosphere that will either heat or cool the planet with disastrous consequences. These arguments have been raging for years and have been the subject of countless articles and studies. Most recently a book,

Why noise is the issue at Kennedy airport

The noise created by the Concorde during takeoffs and landings is much greater than that generated by the Boeing 747 the noisiest of the high-capacity, wide-bodied aircraft The Concorde s noise also covers a far greater area, as this map shows Thus, where some 450,000 people around John F Kennedy Airport are affected by 747 noise, about 549,000 would feel the effects of the Concorde's noise Noise is measured in decibels, with 1 being the slightest sound the normal human ear can hear and 85 being the point at which continuous daily exposure can result in hearing damage The Federal Aviation Administration measures "effective perceived, noise in decibels," or EPNdb This mechanical measurement of sound detects frequencies up to and beyond those audible to the human ear The FAA's 100 EPNdb equals 85 actual decibels. According to the FAA, the Concorde, during takeoffs and landings, generates at least 116 EPNdb vs. 106 EPNdb from the 747.



The Concorde Conspiracy, discusses the whole Concorde problem.

At the bottom of all the pro- and anti-Concorde arguments is the profound disagreement over whether technological progress can or should be stopped. "History shows that each advance in transportation was questioned," reads the British-French official position paper. "At issue were the need for the innovation as well as its possible effects on man's environment. In each case, society found the benefits of the innovation to outweigh the environmental effects. We believe this is true for the Concorde as well."

But this belief brings forth passionate disagreement in Congress. "As we work against the SST we are in a large part redefining progress," says Representative Norman F. Lent (R-N. Y.). "The American people are coming to grips with the realities of environmental rhetoric: No longer will bigger, better, taller, faster be the comparatives of merit." Senator Barry Goldwater (R-Ariz.), though, says, "In all of my experience, I have never known of so much misinformation being put out on any one subject as on the supersonic transport plane."

Going to the courts

Just before its December recess the House voted a six-month ban on SSTs in order to explore further their impact. The ban would apply to airports receiving federal aid from the airport trust fund, which means every major airport in the country except Dulles, which is funded directly by the federal government rather than through the trust fund. Thus if the Senate agrees to the six-month ban, which is likely, and Ford signs the bill, Coleman will have a partial reprieve. He will only have to make a decision about flights to Dulles If the decision is no, there has been speculation that the British and French might then take the U. S. to an international court, claiming that treaties had been violated. However, Bert Rein, a former State Dept. official, testified the treaties do prohibit the U. S. from banning on safety grounds aircraft that France and Britain have certified to be safe. "But we clearly have the right to ban aircraft on environmental grounds," he said.

If the decision is yes, the environmentalists are certain to take that to court and seek an injunction. Also, if his decision is yes, the Port Authority of New York & New Jersey will eventually have to make its own determination on whether the Concorde meets its rigid noise and performance standards at Kennedy airport as the British and French claim. Since the Port Authority is likely to be sued whatever its decision, the betting is that it will decide in favor of Kennedy's angry neighbors and ban the Concorde rather than be sued by its own constituents. If the Concorde ever does land in New York, it will probably not do so much before mid-1977.

Because there are no prospects for a ruling by the Port Authority until late spring at the earliest, additional routes for commercial supersonic transportation are in doubt Tokyo is expected to withhold clearance until New York decides whether to welcome the plane. A New York turndown would discourage other airlines from accepting it and would almost certainly prompt Iran Air—the liveliest prospect at this point—to drop negotiations for purchase of the aircraft. The Japanese, who have options for three Concordes, are also awaiting the New York decision. And the Chinese want to see the Concorde in service to North America before they decide to continue with preliminary purchase discussions

"If we are not allowed to land at Kennedy Airport, it will mean the semi-condemnation of the Concorde as a viable aircraft," says Alain Bruneau, aviation adviser to the French transport minister. "The plane was expressly designed for that mission." Adds Air Vice-Marshal Ian Lawson, director of marketing for BAC's commercial aircraft division "One would be kidding oneself if one said the traffic between North America and Europe was not the most important amount of traffic there is."

Threats of retaliation

Air France commercial director Jean-Claude Martin believes that "it's going to be much tougher to make the Concorde economic if the U. S. is closed off to us. But I just cannot believe we will he cut out. The Americans don't want to kill us." Across the channel Kenneth Binning, the British government's director general for the Concorde program, agrees. If the answer is no, he observes, "I will be very surprised and so will the British and French governments - to put it mildly."

Threats of retaliation have surfaced. In London this week, the *Financial Times* reported both the British and French governments as taking the position that a ban "would be widely viewed as a double standard and lead to reciprocal limitations on U. S. suppliers and air carriers."

In contrast to the U. S House vote to ban the Concorde for six months, the State Dept. wants to give it a three-to six-month trial at Dulles and Kennedy for diplomatic reasons. Last month in a "Dear Bill" letter, Secretary of State Henry Kissinger reminded Coleman that an "outright rejection . . . would be viewed as a serious blow by two of our closest friends and allies whose interests coincide with our own in so many areas." Significantly he concluded his letter with, "I hope that in making the Administration's initial decision with specific regard to the Concorde, you will find it possible to weigh carefully the concerns of these two close allies together with the environmental and other criteria you must consider." The use of the word "initial" for the first time indicates Kissinger thinks the final decision will be President Ford's.

Fred Ward

Coleman. He may permit limited Concorde service at Dulles on a six-month trial

In addition to making threats of retaliation, the French are growing increasingly concerned over the emotional aspects of the anti-Concorde campaign in the U. S. Some think it is a conspiracy by U. S. airlines to hold down competition Others call it a fringe movement that has gained political hearing in Washington because 1976 is an election year.

"We are the target of an extremely violent offensive that uses some extremely dubious arguments," says Bruneau. "We have trouble understanding the exasperating ozone issue. The skin cancer accusation is absurd The Concorde's effect on the ozone layer will be absolutely infinitesimal."

Air France's Martin sees the campaign as rooted in environmentalists' need for an easy target that can produce quick results. "It's easier to stop the Concorde than to clean up the Hudson River," he says.

In France, there is little anti-Concorde activity. Jean-Jacques Servan-Schreiber, a member of the National Assembly and a Paris editor, fought a lonely battle against the program in the early 1970s, but was literally hooted down in the Assembly and widely criticized for his unpopular stance. His magazine, *L'Express*, tried to blow the whistle on the program, but the political momentum, motivated by job protection and national prestige, kept the official French enthusiasm up. And today the French are more taken than Concorde is more than twice as loud as the more noisy subsonic aircraft using Heathrow, such as Boeing Co.'s 707, and up to six times louder than quieter aircraft, such as Lockheed Aircraft Corp.'s TriStar. Says the council: "The recordings indicate that the Concorde could exceed Heathrow noise limits on 80% of its flights."

The BAC's answer to the Heathrow noise results was that the flights were experimental and for training purposes and that full noise-abatement procedures were not used.

But this did not convince British opponents of the Concorde. Says Richard Wiggs, secretary of Britain's Anti-Concorde Project. "As it takes off from Heathrow, in the communities near Heathrow, it is producing noise seven ways Managing Director Henry Marking says. But, he adds: "How can you make a proper commercial estimate when you don't know what routes you'll be able to fly?"

The British ignorance about future SST routes is not confined to the North Atlantic. Britain needs to get supersonic overflying rights from India in order to reach Singapore and similar rights from Indonesia and Australia to reach Melbourne. To reach Johannesburg it needs a refueling stop. Lagos is the obvious place but it is out because of Nigerian objections to South Africa's apartheid policy.

Wherever the Concorde flies, most U.S. airline officials who have studied its economics insist that there is no possible way for the Concorde to oper-

Concorde's U S opponents Hellegers (left) is concerned about the plane's ability to make steep turns Rein believes the SST should be banned on environmental grounds

Goldwater, irked by the "misinformation being put out" by the Concorde's critics

ever with the beauty of the aircraft—its cost and operational economics notwithstanding. The total research and development cost of the Concorde, which has been shared equally by the taxpayers of both countries, is some $3 billion.

If there are no doubters among the French about the Concorde, there are many in Great Britain, which seriously considered killing the project. Some British officials privately doubt the claim that the Concorde can comply with the Port Authority's rule for takeoff noise at JFK. Certainly the British and the French have cause to worry about a report on Concorde noise produced by the Greater London Council following a series of flights into London's Heathrow Airport last summer. The report states that on takeoff the times as loud as the official takeoff noise limit and above the medically recognized threshold of pain." The latest U.S. impact statement and the British results last summer, he avers, show "beyond doubt" that the Concorde is "very much noisier than any other commercial aircraft." BAC, he says, has "been putting the most terrible lies across to ministers about this for years, and now it has caught up with them."

All the uncertainty about the timing and extent of its Concorde operations leaves British Airways uncertain about the financial effect of the aircraft on its operations. In 1974 the airline estimated that the effect of the Concorde on its profits would be anywhere from a contribution of $8 million to a reduction of $50 million a year. These figures still broadly stand, British Airate at a profit, particularly if its diversion from subsonic first class service is taken into account.

According to these officials, who want to remain anonymous to avoid the appearance of meddling in a government-to-government matter, the Concorde would bankrupt Air France and British Airways were it not that French and British taxpayers will be called upon to provide operating subsidies. What ticks these men off is that the Concorde may also bankrupt U.S. airlines that do not have it and cannot afford the $100 million per copy purchase price.

To ease the economic penalties of flying the Concorde, Air France has set the one-way fare from Paris to Rio at $1,477, compared with $1,230 for a regular first class ticket and $794 for

tourist class Even so, Air France claims 3,000 reservations But the problem of fares is a long way from being settled.

Once Washington hurdles are cleared, the next problem facing the Concorde airlines will be the fixing of North Atlantic ticket prices. This will require a new accord on supersonic fares by the International Air Transport Assn. (IATA). Several months of wrangling already concluded in November, when the French agreed reluctantly to a 20% premium over first class' fares for the Air France run to Rio But the Bahrain fare for the British still has not been settled British Airways has been selling tickets at the subsonic first class fare plus 15%, which makes the rate $686 34 on the Concorde compared to $597 20 first class and $419 20 economy class on subsonic jets. IATA may still force BA to charge first class plus 20%

British Airways' Marking notes that his commercial experts believe that first class plus 20% would be a "greater deterrent" to Concorde travel than first class plus 15% But he says, "Personally I'd rather have the money."

The all important North Atlantic zone debates have touched off clashes between the Concorde camp and the subsonic airlines, which fear the loss of their first class business to the Concorde The dispute remains unresolved

Air France wants the Concorde premium over first class fares held to as little as 5%, to ensure a maximum load factor on the route Realistically, though, Air France is ready to compromise at a 15% premium "Above that, we start losing passengers," says Air France's Martin Some U S and European airlines are arguing for Concorde surcharges of 40%. If IATA airlines cannot agree on a supersonic fare, Air France is prepared to withdraw from IATA's North Atlantic zone agreement, according to Martin. This would temporarily break the price-fixing system that most airlines honor, and would allow each to set its own rates. "We are ready to go to an open situation," says Martin.

MOSCOW TO ALMA ATA IN ONE HOUR AND FIFTY FIVE MINUTES, COMRADE — CAN YOU IMAGINE WHAT THIS MEANS TO WORLD TRAVEL?'

Pat Oliphant—The Washington Star

Finally, on top of their existing huge R&D costs, the manufacturers of the Concorde will lose money on every one built. At January, 1974, prices, the British government estimated that the British share of the production losses on 16 aircraft assuming all are sold could be $400 million to $450 million. Since the Concorde is a government project, the production losses will be picked up by British and French taxpayers

When the Concorde program was first conceived in the early 1960s its promotors expected that 400 planes could be sold. Development cost recovery and expected manufacturing profit were based on this volume or something near it But that was before the manufacturers understood the dimensions of the sonic boom problem and the public reaction to it. SNIAS commercial director Jean-Charles Poggi has completed a study that indicates there are now only 12 to 15 routes in the world where the Concorde is suitable. To qualify, a route must be 3,000 mi. to 4,000 mi long and must fly over water or sparsely populated areas most of the way If the load factors are to be anywhere near economic, he estimates that three Concordes are all that are needed for any given route. On that basis, the total production run—all immediate problems aside—should be 45.

But the more immediate problem is what to do with the 16 aircraft that are already committed, and the long lead-time materials for another six that have been ordered. Of the 16, Air France will take four and British Airways is firmly committed to five, although if U. S. landing rights are denied they will not need all of these. Two more are not up to production standard and will not be sold. That leaves five, and only the Iranians and perhaps the Japanese and Chinese show a real interest.

'But it's a beautiful ride'

Already the production lines at BAC and SNIAS are as slow as they can go, and layoffs are a distinct possibility this spring. As Britain's Binning says, "Certainly I cannot envisage Her Majesty's Government being prepared to authorize further production unless there is evidence that it is commercially required."

All of which is certainly music to the environmentalists' ears. The last remaining hope for the British and French is that conditions will change when the Concorde starts flying. "The vital information we haven't got is on how the market reacts when the plane is flying," says Binning. And British Airways' Marking sees his Concorde services putting "a great deal of pressure" on other airlines with parallel routes to operate the Concorde, though he expects this will be done by leasing flying hours on the Concorde instead of buying the plane outright. Poggi of SNIAS insists the French determination is long range in spite of his government giving the Concorde only one year to prove itself. He expects airlines to show more enthusiasm for the Concorde when they begin renewing their fleets in the 1980s.

It seems like a slim hope, but it is probably a real one. One U. S. aeronautical engineer who has been as influential in shaping the designs of big commercial airplanes as anyone, admires the Concorde as a sophisticated, successful achievement. He also thinks it will be an economic disaster for the airlines that operate it unless they get very large subsidies.

After riding the Concorde he said, "I haven't changed my mind about the economic characteristics. But it's a beautiful ride. It may just be the best airplane ride anyone has ever had. We'd better prepare ourselves for the probability that when people get a chance to travel on this airplane, they're going to love it." ■

ACTIVITY 6: The SST Hearing — A Role Play Simulation

Overview

The SST question had raised heated debate over the past two decades. Several years ago, for a variety of reasons, the United States government decided against developing its own super sonic transport. However, this plane was developed by France and Great Britain and begun commercial flights. As a result, another debate confronted U.S. decision makers. This time, French and British airlines requested permission to land at U.S. airports so that they could provide transatlantic service. Without this important air route, the prospect of this airplane becoming a profitable investment for these airlines would be reduced.

In this simulation activity you will conduct a Senate hearing on the question of granting landing rights to the Concorde SST. Seven members of the class will represent senators who will decide whether or not the SST may use U.S. airports. Other class members will represent different interest groups, each with a different reason for allowing or not allowing the SST to land. After hearing the arguments presented, the senators will vote on the question.

The purpose of this activity is to examine some of the concerns related to the SST debate; these concerns span a wide range of issues — economic, social, technical, environmental and political.

Simulation Procedures

Senate Committee:

Seven members of the class will serve on the Senate committee. Each person will assume the role of one of the senators listed.

Senators from:	New York (1)	Ohio (1)
	California (1)	Texas (1)
	Nebraska (1)	Minnesota (1)

Each senator will need to:

- Learn about the state he/she represents.
- Understand the needs and concerns of the people he/she represents. (How do you think the people of your state feel about the SST?)
- Determine if the state will or will not benefit from the SST flights. (What advantages will the SST bring to your state?)
- Identify some of the arguments the U.S. Government has given in favor or against the SST landings.
- Prepare a list of questions to be asked of each witness based on the concerns he/she has identified. This list of questions should reflect the ideas and opinions of the senator he/she represents.
- Elect a chairperson to conduct the meeting so that it will progress in a smooth and orderly fashion. This includes making sure that each group has an equal amount of time to present its case, that witnesses do not speak out of turn, and that questioning does not become irrelevant or "side-tracked."

Special Interest Groups:

The remaining members of the class will represent one of the six different interest groups. (There should be an approximately equal number of members in each group.) Each group will develop a presentation supporting its position to be given before the Senate Committee.

Group A. Members of National Council for a Better Environment
Group B. Representatives of the U.S. Energy Office
Group C. Concerned Citizens Group
Group D. Representatives of American Business Association
Group E. Leaders of United Airline Workers of Britain
Group F. Owners of French and British Airlines

Members of each group will need to:

- Understand the position, opinions and feelings of the group he/she represents.
- Reread the "Concorde" article carefully and identify the important points that support the group's position.
- Conduct any necessary outside research that may provide additional information. (Each member of the group may wish to examine a different phase or aspect of the argument or the group may wish to work together.)
- Identify the most important arguments in support of the group's position and discuss those ideas.
- Develop a logical and convincing set of arguments to present to the Senate hearing.
- Select spokesperson(s) to give the presentation. Or, each member of the group may give part of the presentation, providing a different aspect of the argument.

Hearing

- Each group is allowed ten minutes to make its presentation.
- After each group presents its position, each senator may ask a maximum of three questions. (The group members may discuss the question among themselves before answering the question.)
- When all arguments have been presented and all questioning completed, each group will be allowed three minutes to give a summary of its arguments before the senators.
- Upon completion of the hearing, the senators will meet to vote. The chairman of the committee will announce the outcome and give an explanation for its decision. (It is suggested that the explanation of the decision be written out so that all the senators can express their opinions. One possible format for this announcement is to indicate how each senator voted and the main reason for that vote.)

INTEREST GROUPS AND THEIR POSITIONS

Group A. Members of the National Council for a Better Environment

As a member of this group, you see pollution as a major reason to ban the SST from making regular flights to the U.S. You also feel that this plane will damage the ozone layer which protects us from harmful sun rays. You are deeply concerned with the need to keep our environment a healthy place to live and feel people can no longer continue to abuse it. It is time for citizens and government officials to take steps to prevent damaging environmental effects that this plane will create. You feel our cities have more than their share of air and noise pollution. Any increase in pollution will further endanger the health of the residents.

Group B. Representatives of the United States Office of Energy

As a member of this group you are concerned with the alarming rate at which our limited energy resources are being consumed. You are experts on the energy situation and feel that fossil fuels such as oil should not be carelessly used. In this case, the SST uses large quantities of fuel, and the only benefit from this plane is a few hours of travel time saved. Yet, it carries far fewer passengers than conventional jets. (Use whatever data you find to support your position.) Also, you have proposed new energy conservation plans for the U.S. To allow the SST to land here goes against all your efforts to convince people that the energy situation is a critical issue and that everyone must do their part to save fuel.

Group C. Concerned Citizens Group

As a member of this group you are strongly opposed to the SST landing at our airports. You live adjacent to Kennedy Airport where the planes will land. You argue that you and your families will suffer severely when these planes fly overhead. The noise problem with the existing jets is bad enough. It can only get worse if the SST flies into the airport regularly. You cannot bear to think of the added noise and aggravation the supersonic planes will create. You also believe that the risk of mid-air accidents with this faster plane will increase. This further endangers those living near the air traffic lanes. The airport is among one of the world's busiest and is located in the most densely populated section of the country. You are tired of the airport officials not listening to the needs of its neighbors. Even now people have a hard time selling their homes because no one wants to live close to a noisy airport. Your group is ready to take any action necessary to stop this plane from using this airport.

Group D. Representatives of the American Business Association

As a member of this group, you are in favor of the SST. You feel the SST will be important in helping to increase business between Europe and the United States. The faster one can travel across the ocean, the less wasted time business executives will have in transporting their goods and services. Saving time is the same as saving money. With the SST, business people can fly across the ocean, conduct their business and return home the very same day.

Also, many American companies supply equipment and parts for the production of the SST. If production of these planes decline, they will lose much business. Moreover, you know that the European companies spent a great deal of money to develop this new plane. If they do not have enough air routes and passengers, these companies will stand to suffer great losses. You believe countries should help one another by supporting each other's business. This is important in good trade relationships.

Group E. Leaders of the United Airline Workers of Britain

As a member of this Group you do not see any good reason for prohibiting the SST to land at U.S. airports. You have come here from Britain to present the plight of the British and French airline workers. You explain how British and French airline workers depend on the production of the SST to provide jobs. The SST has been the major stimulus to the economy. It has provided employment to many workers. If few air routes are opened to the SST, production of the planes would have to be cut back drastically, if not halted altogether. If this were to happen, many men and women will be out of work again and back on the unemployment lines. You must convince the senators of how bad things will be if the U.S. bans these flights. It is more than just yourself; it is the thousands of workers you are representing.

Group F. Owners of French and British Airlines

As a member of this group, you must show how important it is to land these planes in the U.S., both for economic and political reasons. Your two airlines and governments have spent enormous sums of money in order to build the SST. You fear that this venture will be a complete failure without the U.S.'s help and participation. If the U.S. supports this plane, other countries will be more willing to allow the SST to land at their airports, and in addition, may order the plane for their airlines. You are not only thinking of your own losses but that of others who have invested in the project and depend on its success. You must also point out how French and British political relations with the U.S. might be strained if the landing rights were denied. You must make an all out effort to save this plane from failure by developing a strong case in support of its right to land. Many people are relying on you to convince the senators of the benefits of this plane.

SENATOR'S WORKSHEET

Interest Group Name	Argument	Facts Presented	Benefits to My State	Disadvantages to My State	Questions to Ask

1) Fill in the columns as the arguments are presented by the various interest groups; 2) Write down any question you may wish to ask the spokesperson; do not interrupt his/her presentation. Ask your questions at the end of the presentation.

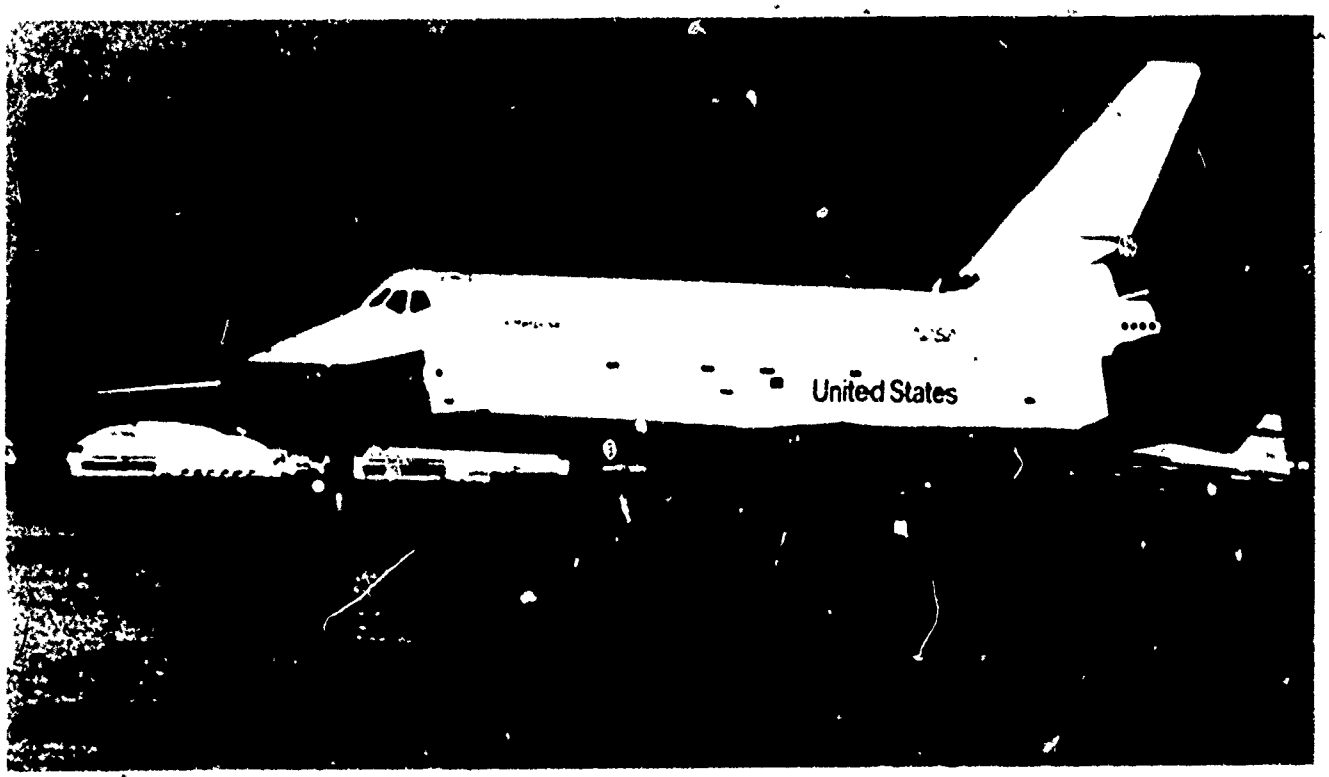
SPACE SHUTTLE

One of the most recent and dramatic advances in transportation is the space shuttle. The space shuttle represents a bold attempt to conquer the limits of space and to reap the benefits it has to offer. This type of transportation, which was a mere dream in the minds of science fiction writers a few short years ago, is now a reality for our present generation. Science and technology have brought us into an era where space travel will take place alongside the other more conventional modes of travel.

Many space enthusiasts feel that this shuttle could solve many earth-related problems from future energy sources to providing new places to live. Some feel that with the shuttle we will be able to conduct a variety of scientific experiments not possible on earth. The shuttle will be able to launch, record and repair satellites which are used for communications, surveying natural resources and monitoring military activities. The possibility of space colonies, space industries and harnessing solar energy to be beamed back to earth are all exciting and fascinating ideas.

This enthusiasm, however, is not shared by all. Many people, including government officials who vote on government spending, feel that this type of activity is a waste of time and money. Many question the amount of resources (time, money, materials) which are being expended on this project (that is, do we really need it?).

Read the article titled, "The Shuttle Era." The article was selected to introduce you to one of the latest forms of transportation and its implications for our society. Read the article carefully and discuss the questions which follow.



SHUTTLE ALT FREE FLIGHT LANDING The rear wheels of the Space Shuttle Orbiter 101 raise desert sand on the landing strip at Edwards Air Force Base as the Enterprise completes the fourth of five scheduled Approach and Landing Test (ALT) free flights This mission marked the first occasion for the Orbiter to fly minus tail cone The unpowered phase, with Astronauts Joe H Engle, commander, and Richard H Truly, pilot controlling the Enterprise, took two minutes and 34 seconds One of the T-38 chase planes that remained with the Shuttle craft for the mission's duration is partially visible at right

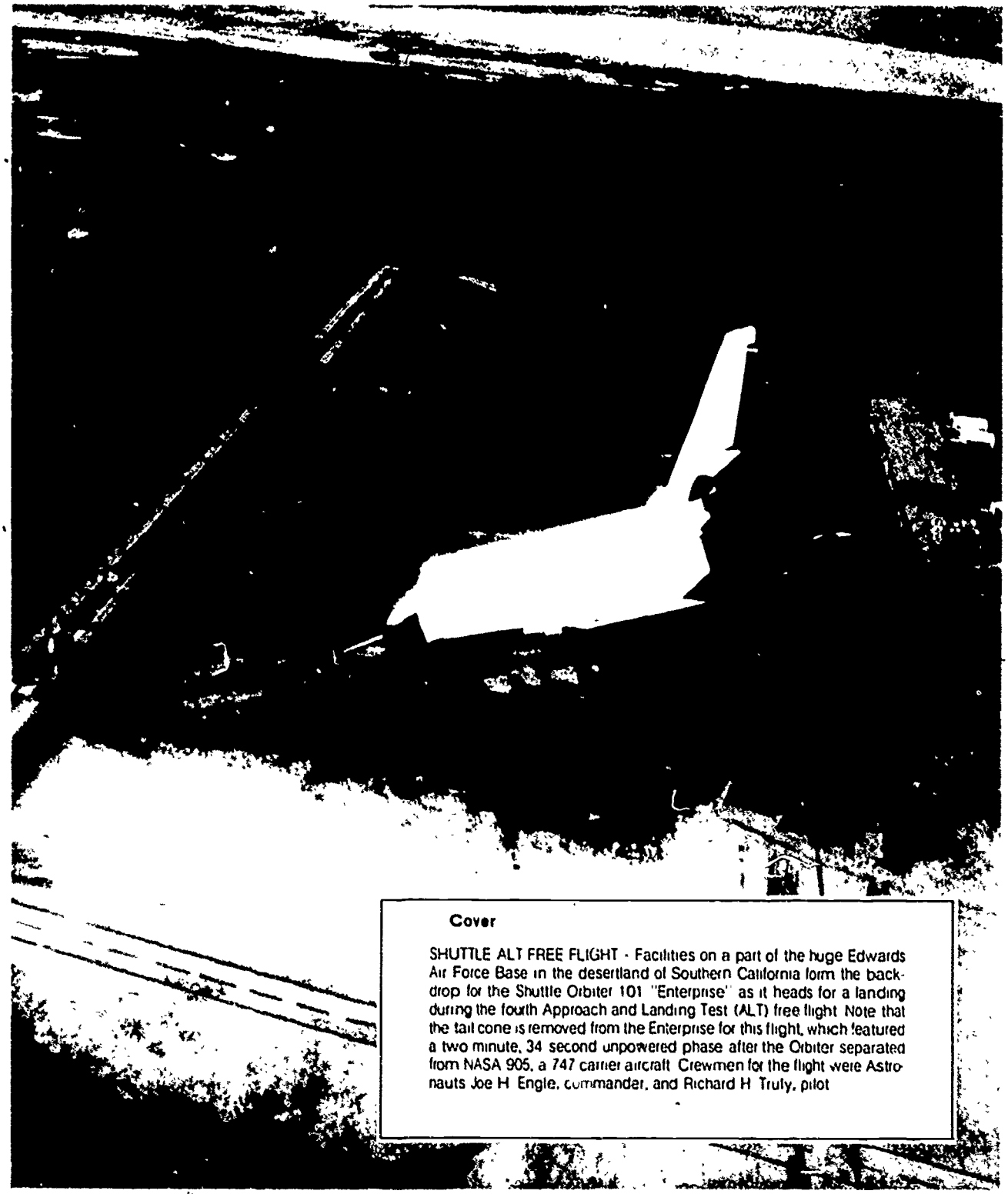
Reading 9

The Shuttle Era

NASA
National Aeronautics and Space Administration

Space Shuttle Fact Sheet
December 1977

Lyndon B. Johnson Space Center



Cover

SHUTTLE ALT FREE FLIGHT - Facilities on a part of the huge Edwards Air Force Base in the desertland of Southern California form the backdrop for the Shuttle Orbiter 101 "Enterprise" as it heads for a landing during the fourth Approach and Landing Test (ALT) free flight. Note that the tail cone is removed from the Enterprise for this flight, which featured a two minute, 34 second unpowered phase after the Orbiter separated from NASA 905, a 747 carrier aircraft. Crewmen for the flight were Astronauts Joe H. Engle, commander, and Richard H. Truly, pilot.

The Shuttle Era

On December 17, 1903, Orville and Wilbur Wright successfully achieved sustained flight in a power-driven aircraft. The first flight that day lasted only 12 seconds over a distance of 37 meters (120 feet), which is about the length of the Space Shuttle Orbiter. The fourth and final flight of the day traveled 260 meters (852 feet) in 59 seconds. The initial notification of this event to the world was a telegram to the Wrights' father

Sixty-six years later, a man first stepped on the lunar surface and an estimated 500 million people around the world watched the event on television or listened to it on radio as it happened.

Building upon previous achievements, new plateaus in air and space transportation have been reached — military aviation, airmail, commercial passenger service, the jet age, and manned space flight Now a new era nears. The beginning of regularly scheduled runs of NASA's Space Shuttle to and from Earth orbit in the 1980's marks the coming of age in space. The Shuttle turns formidable and costly space missions into routine and economical operations that generate maximum benefits for all people. Shuttle opens space to men and women of all nations who are reasonably healthy and have important work to do there.

The Shuttle launch vehicle is composed of the airplane-like Orbiter spacecraft, the large external fuel tank, and the two solid rocket boosters (SRBs) This is a high-angle view of the launch.

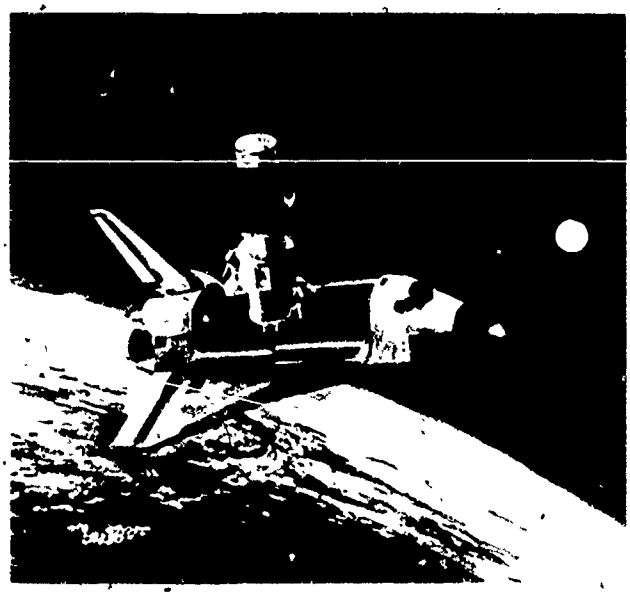
The Interim Upper Stage (IUS) is deployed from open payload bay of Shuttle Orbiter into space by the Orbiter's remote manipulator (artist's concept). The IUS can rocket spacecraft to higher orbits than the Shuttle can reach or into interplanetary trajectories. The IUS is one of two expendable, low-cost propulsion vehicles which are being considered for the Space Transportation System.

A Versatile Vehicle

Space Shuttle is a true aerospace vehicle. It takes off like a rocket, maneuvers in Earth orbit like a spacecraft, and lands like an airplane. The Space Shuttle is designed to carry heavy loads into Earth orbit. Other launch vehicles have done this. But unlike the other launch vehicles which were used just once, each Space Shuttle Orbiter may be used again and again.

Moreover, Shuttle permits checkout and repair of unmanned satellites in orbit, or return of the satellites to Earth for repairs that could not be done in space. This will result in considerable savings in spacecraft costs. Satellites that the Shuttle can orbit and maintain include those involved in environmental protection, energy, weather forecasting, navigation, fishing, farming, mapping, oceanography, and many other fields useful to man.

Interplanetary spacecraft can also be placed in orbit by the Shuttle, together with a rocket stage called the Interim Upper Stage (IUS) which is being developed by the Department of Defense. After the IUS and spacecraft are checked out, the IUS is ignited to accelerate the spacecraft into deep space. The IUS will also be employed to boost satellites to higher orbits than the Shuttle's maximum altitude — about 1,000 kilometers (approximately 600 miles).



The large Space Telescope is being designed as an optical telescope observatory to be used in Earth orbit, unhindered by atmospheric distortion. Here, it is being shown deployed in orbit by the Space Shuttle.

Unmanned satellites, such as the Space Telescope, which can multiply man's view of the universe, and the Long Duration Exposure Facility (LDEF), which can demonstrate the effects on materials of long exposure to the space environment, can be placed in orbit, erected, and returned to Earth by the Space Shuttle. Shuttle crews can also perform such services as replacing the Space Telescope's film packs and lenses. The Space Telescope is being studied by Marshall Space Flight Center, Huntsville, Alabama, and Goddard Space Flight Center, Greenbelt, Maryland, while LDEF is a product of Langley Research Center, Hampton, Virginia.

The Shuttle is a manned spacecraft, but unlike manned spacecraft of the past, like Mercury, Gemini, and Apollo, it touches down like an airplane on a landing strip. Thus, the Shuttle eliminates the need for the expensive sea recovery force required for Mercury, Gemini, and Apollo. In addition, unlike the previous manned spacecraft, the Shuttle is reusable.

With its comparatively short turnaround time, it can be refurbished and ready for another journey into space 2 weeks after landing.

The Shuttle can quickly provide a vantage point in space for observations of transient astronomical events or of sudden weather, agricultural, or environmental crises. Information from Shuttle observations could contribute to sound decisions for countries dealing with such problems.

The Shuttle is scheduled to carry a complete scientific laboratory called "Spacelab," into Earth orbit. Developed by the European Space Agency (ESA), Spacelab is similar to earthbound laboratories but adapted to operate in zero gravity (weightlessness). It provides a shirtsleeve environment, suitable for working, eating, and sleeping without the encumberance of special clothing or space suits.

Spacelab provides facilities for as many as four laboratory specialists to conduct experiments in such fields as medicine, manufacturing, astronomy, and pharmaceuticals. Spacelab remains attached to the Shuttle Orbiter throughout a mission. Upon return to Earth, Spacelab is removed from the Orbiter and outfitted for its next assignment. It can be reused about 50 times.

Spacelab personnel will be men and women of many nations, experts in their fields, and in reasonably good health. They will require only a few weeks of space flight training.

Participating ESA nations are Belgium, Denmark, France, Italy, The Netherlands, Spain, Switzerland, United Kingdom, Austria, and the Federal Republic of Germany (West Germany). Spacelab is an example of international sharing of space costs and of worldwide interest in the study of science in a space environment.

Projects that only recently were considered impracticable become feasible with Space Shuttle. Shuttle can carry into orbit the building blocks for large solar power stations that would convert the abundant solar heat and sunlight of space into unlimited supplies of electricity for an energy-hungry world. These building blocks would be assembled by specialists, transported, and supported by Space Shuttle.

The Shuttle can also carry the building blocks for self-sustaining settlements into Earth orbit. Inhabitants of these settlements could be employed in such vital occupations as building and maintaining solar power stations and manufacture of drugs, metals, glass for lenses and electronic crystals. Manufacturing in weightless space could reduce costs of certain drugs, create new alloys, produce drugs and lenses of unusual purity, and enable crystals to grow very large. Drugs, metals, glass, and electronic crystals will also be manufactured during Spacelab missions, long before establishment of any space settlement.

A major planned payload for the Space Shuttle will be Spacelab, being developed under auspicies of the European Space Agency (ESA), shown tucked safely in the Space Shuttle Orbiter's huge payload bay in this artist's concept. Shuttle capabilities will make it possible for the world's leading scientists to go into space and perform their experiments and studies, then return to Earth to put the information to use. This particular concept shows the Spacelab configured for an extravehicular activity.

Space Shuttle System and Mission Profile (Principal Components)

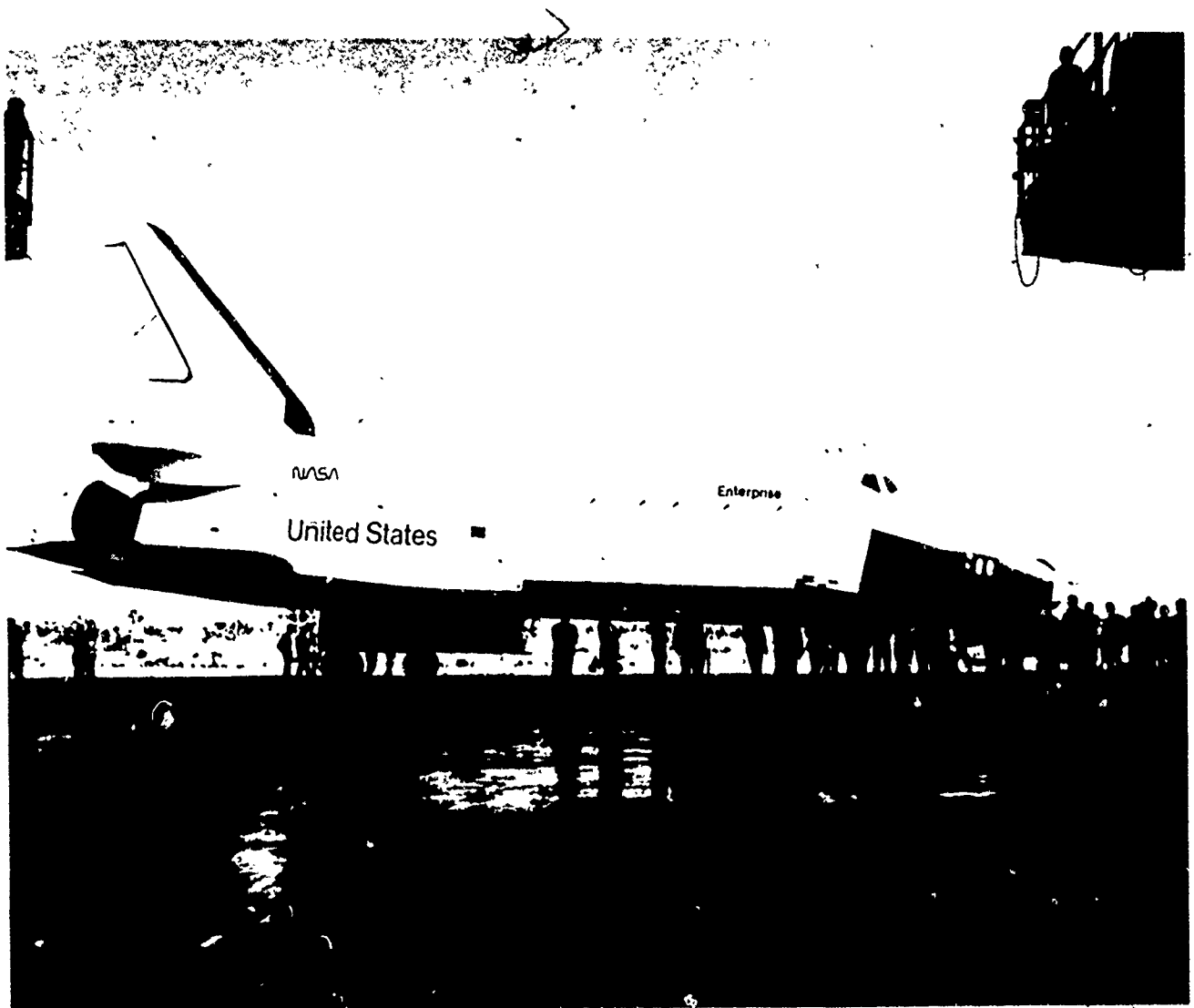
The Space Shuttle flight system is composed of the Orbiter, an external tank (ET) that contains the ascent propellant to be used by the Orbiter main engines, and two solid rocket boosters (SRB's). Each booster rocket has a sea level thrust of 11.6 million newtons (2.6 million pounds). The Orbiter and SRB's are reusable, the external tank is expended on each launch.

The Orbiter is the crew and payload carrying unit of the Shuttle system. It is 37 meters (122 feet) long and 17 meters (57 feet) high, with a wingspan of 24 meters (78 feet) and weighs about 68,000 kilograms (150,000 pounds) without fuel. It is about the size and weight of a DC-9 commercial air transport.

The Orbiter can transport a payload of 29,500 kilograms (65,000 pounds) into orbit. It carries its cargo in a cavernous payload bay 18.3 meters (60 feet) long and 4.6 meters (15 feet) in diameter. The bay is flexible enough to provide accommodations for unmanned spacecraft in a variety of shapes and for fully-equipped scientific laboratories.

The Orbiter's three main liquid-rocket engines each has a thrust of 2.1 million Newtons (470,000 pounds). They are fed propellants from the external tank which is 47 meters (154 feet) long and 8.7 meters (28.6 feet) in diameter.

At liftoff, the tank holds 703,000 kilograms (1,550,000 pounds) of propellants, consisting of liquid hydrogen (fuel) and liquid oxygen (oxidizer). The hydrogen and oxygen are in separate pressurized compartments of the tank. The external tank is the only part of the Shuttle system that is not reusable



A ground-level view of the Space Shuttle Orbiter 101 "Enterprise" during rollout activity at the Rockwell International Space Division's Orbiter manufacturing facility at Palmdale, California, September 17, 1976. A crowd of 2,000 NASA, congressional, and industry people, and invited guests were on hand at Palmdale for the first public viewing of the Orbiter 101

Crew and Passenger Accommodations

The crew and passengers occupy a two-level cabin at the forward end of the Orbiter. The crew controls the launch, orbital maneuvering, atmospheric entry, and landing phases of the mission from the upper-level flight deck. Payload handling is accomplished by crewmen at the aft cabin payload station. Seating for passengers and a living area are provided on the lower deck. The cabin will have a maximum of utility, mission flexibility is achieved with a minimum of volume, complexity, and weight. Space flight will no longer be limited to intensively-trained, physically perfect astronauts but will now accommodate experienced scientists and technicians.

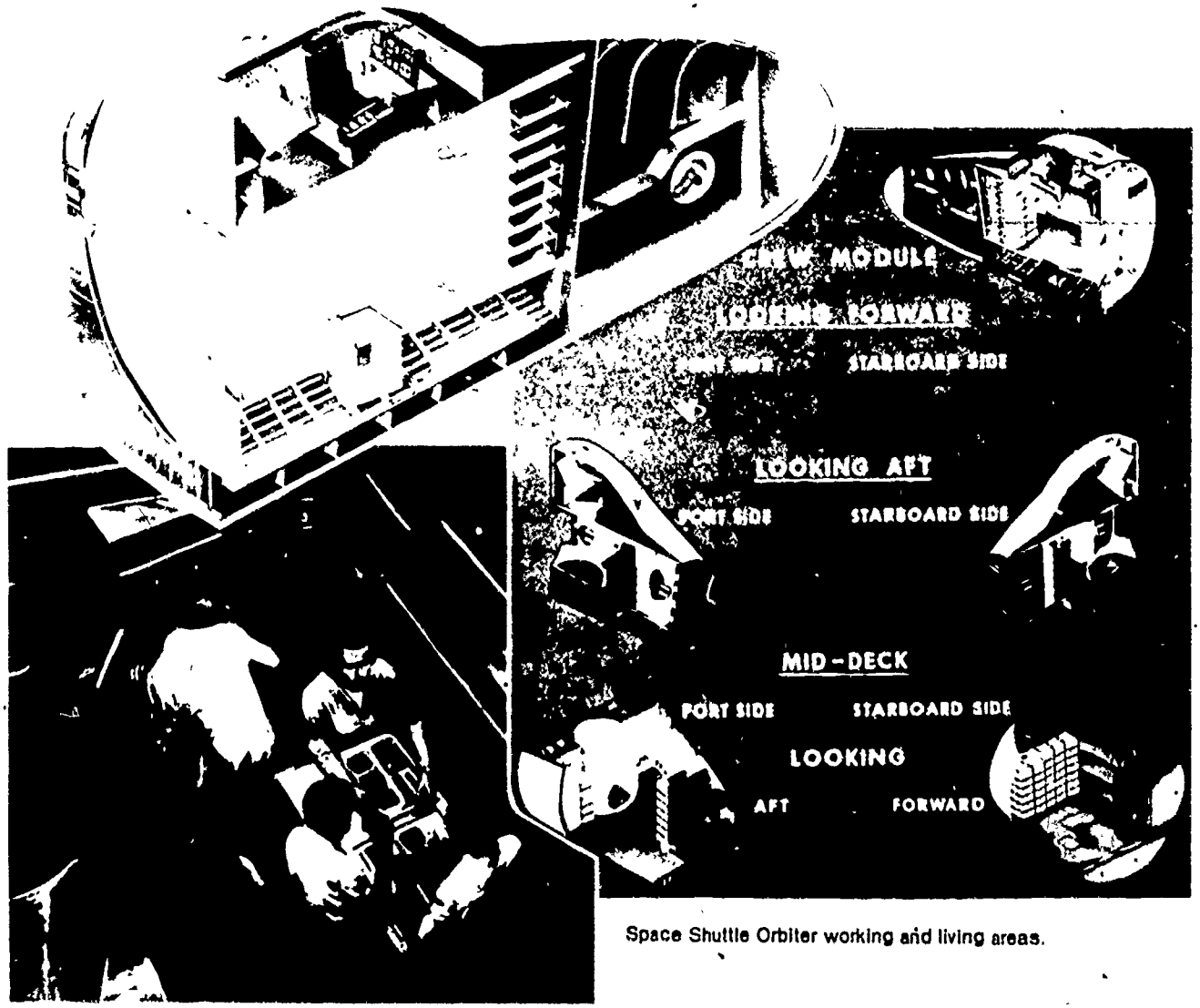
Crewmembers and passengers will experience a designed maximum gravity load of only 3g during launch and less than 1.5g during a typical reentry. These accelerations are about one-third the levels experienced on previous manned flights. Many other features of the Space Shuttle, such as a standard sea-level atmosphere, will welcome the nonastronaut space worker of the future.

Typical Shuttle Mission

The Space Shuttle mission begins with the installation of the mission payload into the Orbiter payload bay. The payload will be checked and serviced before installation and will be activated on orbit. Flight safety items for some payloads will be monitored by a caution and warning system.

In a typical Shuttle mission which lasts from 7 to 30 days, the Orbiter's main engines and the booster ignite simultaneously to rocket the Shuttle from the launch pad. Launches are from the John F. Kennedy Space Center in Florida for east-west orbits, or Vandenberg Air Force Base, California, for polar or north-south orbits.

At a predetermined point, the two unmanned solid-rocket boosters separate from the Orbiter and parachute to the sea where they are recovered for reuse. The Orbiter continues into space. It jettisons its external propellant tank just before orbiting. The external tank enters the atmosphere, and breaks up over a remote ocean area.



Space Shuttle Orbiter working and living areas.

In orbit, the Orbiter uses its orbital maneuvering subsystem (OMS) to adjust its path, for rendezvous operations and, at the end of its mission, for slowing down so as to head back toward Earth

OMS propellants are monomethyl hydrazine as the fuel and nitrogen tetroxide as the oxidizer. They ignite on contact eliminating the need for ignition devices.

The Orbiter does not necessarily follow a ballistic path to the ground as did predecessor manned spacecraft. It has a crossrange capability (can maneuver to the right or left of its entry path) of about 2,000 kilometers (1,270 miles)

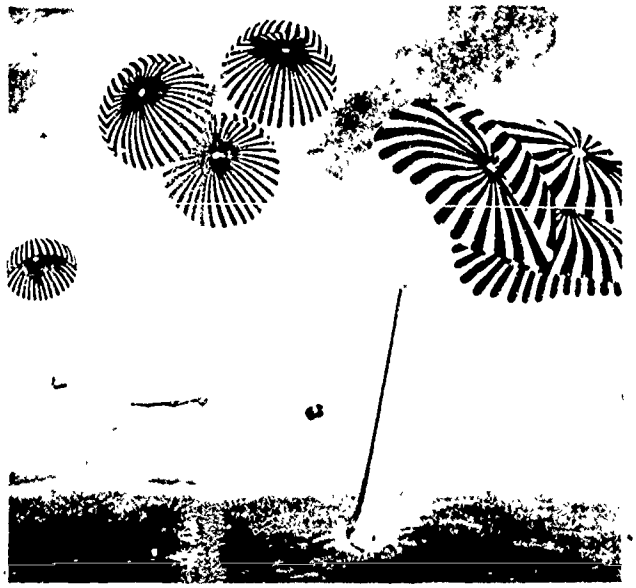
The Orbiter touches down like an airplane on a runway at Kennedy Space Center or Vandenberg Air Force Base. Landing speed is about 335 kilometers per hour (212 to 226 miles per hour). After approximately 2 weeks for refurbishing, the Shuttle is ready for another space mission.

Space Shuttle Vehicle Crew

The Shuttle crew can include as many as seven people: the commander, the pilot, the mission specialist who is responsible for management of Shuttle equipment and resources supporting payloads during the flight, and one to four payload specialists who are in charge of specific payload equipment. The commander, pilot, and mission specialist are NASA astronauts. Payload specialists conduct the experiments and may or may not be astronauts. They are nominated by the payload sponsor and certified for flight by NASA.

Shuttle Management Team

NASA's Lyndon B. Johnson Space Center, Houston, Texas, manages the Space Shuttle program and is also responsible for development, production, and delivery of the Orbiter



Solid rocket boosters landing at sea, where they will be picked up for reuse.

NASA's George C. Marshall Space Flight Center, Huntsville, Alabama, is responsible for the development, production, and delivery of the solid rocket booster, the external propellant tank and the orbiter main engines. Test firings of Shuttle engines are carried out at NASA's National Space Technology Laboratories, Bay St. Louis, Mississippi.

NASA's John F. Kennedy Space Center, Florida, is responsible for design and development of launch and recovery facilities and for operational missions requiring easterly launches.

Thousands of companies make up the Shuttle contractor team. They are located in nearly every state of the United States.

A Space Shuttle Orbiter approaches a landing field at NASA's Kennedy Space Center, Florida, following a flight in space. The Orbiter will be able to land on a conventional runway similar to that used by present-day jet aircraft.

NASA–S–76–815 A

PIONEER TRANSPORTATION SYSTEMS

Recorded times to travel from coast to coast.

By Covered Wagon
166 days (1849)

By Stage Coach
60 days (1860's)

By Train
11 days (1870's)

By Air
26½ hours (1923)

By DC-3
17½ hours (1938)

By 747
5 hours (1975)

The Space Shuttle Orbiter will cross the United States in only 8 minutes (1980)

U. S. MAN–HOURS IN SPACE

PROGRAM	MERCURY	GEMINI	APOLLO	SKYLAB	ASTP
PROGRAM MAN-HOURS IN SPACE	54	1 940	7 506	12 351	652
NUMBER OF MANNED FLIGHTS	6	10	11	3	1
CREW SIZE	1	2	3	3	3

CUMULATIVE MAN HOURS IN SPACE

22,503 HOURS 49 MINUTES 50 SECONDS

☆ U.S. GOVERNMENT PRINTING OFFICE: 1978—771-088/2071

THE SPACE SHUTTLE: Advantages And Disadvantages

Instructions: In the spaces below, list some possible benefits and disadvantages of the Space Shuttle System and Space Colonies. Some have been identified in the reading; others you will have to predict.

SPACE SHUTTLE SYSTEM	
BENEFITS	PROBLEMS OR DISADVANTAGES
SPACE COLONIES	
BENEFITS	PROBLEMS OR DISADVANTAGES

(Save this completed worksheet which will help you answer the questions on pg. 65)

QUESTIONS: SPACE SHUTTLE TRANSPORTATION

Use the "advantages and disadvantages" list (Handout 7) you just compiled to help you discuss the following questions:

- Does the United States have the right to claim any portion of space to be used for building space colonies, as well as the space path for the shuttle? Why or why not?
- Earth inhabitants have polluted, drained resources and irreparably damaged parts of the earth. Should safeguards be taken to insure this does not happen elsewhere in the universe because of the space shuttle system? If so, what should be done?
- Many people are starving and dying of many diseases in the world. Why should so many billions of dollars be spent on this space shuttle? Why not use the money to help the poor, or use it for research to cure diseases (e.g., cancer, children's diseases, birth defects)?
- The U.S. government spends billions of tax payers' dollars for space research and to send trial runs of the space shuttle into orbit. Both rich and poor people contribute their tax money to this exploration. However, when it comes time to use this space shuttle system, perhaps only the rich will have the money or possible need to use it. Is this fair to the poorer tax payer? Why? What could or should be done?
- Great strides have been made in air transportation since the time of the Wright brothers. These achievements can be attributed to our highly developed science and technology. We now have great mobility as a society. Compare this mobility to the adverse effects brought upon our environment (e.g., resource depletion, pollution, increase in accidental deaths). a) Has it been worth it? b) Should limits be put on future development? c) Do we need this great mobility? Why?

DILEMMA 7: "Space Litter"

Spacecraft Starcruiser is proceeding on its regular supply run to Space Colony Martite. As it approaches the colony for landing, the emergency warning system suddenly flashes on. Captain Sue Hodges rushes to the control room and discovers that the spacecraft's primary engine is in trouble. The instruments indicate that the ship is rapidly losing power. Information from the computers is analyzed, and the captain concludes that there is only one way to save the ship and land the crew safely on Martite. They will have to reduce the weight of the spacecraft. This can be done by casting out the drums of chemical fuel they are transporting to Martite.

However, the chemical fuel is highly combustible. Although it is contained in steel-lined drums, any sudden impact will cause a violent explosion. If the spacecraft were further out, the drums of chemicals can very easily float out into space. But here, they are in the direct traffic approach lane to Martite where spacecrafts travel constantly, bringing food, supplies and fuel. A collision between a spacecraft and one of these chemical filled drums would be disasterous; the explosion could easily blow up the craft and its passengers. Furthermore, because they are so close to Martite, a drum could conceivably be drawn into its gravitational field and crash into the colony.

Captain Hodges must make an immediate decision. If she reduces the weight, the crippled ship has a good chance of safely landing on Martite.

Should Captain Hodges cast out the drums of chemical fuel? Why or why not?

DISCUSSION QUESTIONS

- Should the safety of the ship and the crew be Captain Hodges' main concern when she makes her decision? Why or why not?
- Should the possibility of damage to other spacecrafts or the space colony caused by the cast-off drums be of concern to Captain Hodges? Why or why not?
- What should be the Captain's major responsibility? Why?
- If you were one of the crew members, what do you think Captain Hodges should do? Why? What if you were a resident of Martite?
- If Captain Hodges were not so close to Martite, would that make any difference in the decision she makes? Why?
- Should anyone have a right to leave dangerous articles out in space? Why or why not?
- What might be the best reason for not discarding the cargo?
- Should the crew members have a right to take part in making the decision? Why?
- Should Captain Hodges attempt to land on Martite without first reducing the Spacecraft weight? Why or why not?
- Should the captain be blamed if the cast-off drums caused a disaster? Why or why not?
- In what ways is this dilemma similar to crippled Skylabs falling back to Earth? Who should be blamed if people are fatally injured by the falling debris?

SECTION IV:
Future Perspectives

ACTIVITY 7: Transportation in the Future: A Scenario Writing Exercise

Writing A Scenario

A scenario is a short story or a description of a possible event or action. It is a useful exercise to explore a new or different idea. In writing a scenario one takes an idea and follows where that idea might lead. It is like asking the question, "What would happen if I did this?" One tries to think of the many effects of a certain decision and the kinds of changes that might take place. One type of change may cause other changes. When one starts thinking about the changes that might occur, a new scene unfolds — a scenario story.

However, a scenario is more than just a list of changes or effects, because it tries to tie in the different and possible kinds of changes and weave together a complete story. Many people develop scenarios to help them make future decisions. With a scenario, one can begin to picture new or different ideas more completely because many effects are being examined at one time.

For example, if one wanted to establish a space community one would want to think about all that is required and plan to meet those needs. The scenario's description might include the number and kinds of people living there, the work to be done, kinds of food and housing, what people would do for recreation and during free time, and so on. One might decide that all the work would be done by robots. What then would the humans do? Would all the free time be used for such activities as playing baseball, watching television, painting, composing music, hobbies? Will the people have enough to do to keep them busy? Would they become bored and lazy? What are the advantages of using robots? Disadvantages?

Here are some helpful questions to help guide you in writing your scenario:

- What are the main ideas of the situation?
- How well does the story hold together? Does one idea relate to another to build a complete story?
- Do you have any suggestions about how the different problems might be solved?
- Are your arguments well presented? How might you make your ideas more believable? Are they interesting to the reader?

From the following list of scenario themes, select one to develop into a two-or three-page scenario. Put yourself into the future and try to imagine what could be. Your scenario should be a complete story. You can make up characters and describe how they might act in that situation.

1. New cities are developing all over the country. Greater care is being placed in the planning of transportation systems that will help reduce traffic congestion, noise and air pollution.

   Imagine that you have been selected to prepare a transportation plan for the new city of Metro. In preparing your plan, keep in mind the following points: a) First give a brief description of the city. b) Your plan must be able to adjust to population growth and other changes and not become obsolete in a few years. c) Environmental concerns must be met. d) Include a plan for mass transportation that is economical and efficient. e) You will have a voice in the planning of the downtown area to avoid traffic problems. f) What will be the main forms of transportation?

2. As chief designer for a major auto maker you have been asked to design a car for the year 2,000. This car has to have features to please many divergent groups — consumers, manufacturers and environmentalists.

   Write a scenario describing this type of vehicle of the future. It does not need to have all the technical aspects, just the points which could be appreciated by the average consumer. Keep the following points in mind when writing your scenario: a) What do consumers want in a car of the future? b) If there is an oil shortage, how might this affect the car you design? c) What safety devices might be included? d) Will manufacturers have to make drastic changes in the way they produce cars? 3) If you design an electric car, what changes will result; what will happen to gasoline stations?

3. Imagine being in the year 2,500 (about 500 years from now). You are living on a space colony. This space colony may resemble some of those seen in space adventure movies on TV and in the movie theaters.

   Describe the type of transportation which might be used on this colony. Discuss the following: a) personal transportation, b) mass transportation, c) inter-galactic travel and any other type of futuristic transportation vehicle or systems of transportation you can think of for your story. Include your ideas on the benefits and desirability of those forms of travel.

4. Suppose that there is a sudden gasoline shortage because the oil producing countries cannot produce enough oil to meet the world demand. Our country's gasoline supply has been reduced by one-half. As the Secretary of Energy, develop a plan to distribute the limited supply of gasoline. Should the gasoline be rationed? How should the gas be rationed? Should each person be allowed to buy so much gasoline each month? Would this be fair to everyone? How might a traveling salesman be affected? Should there be a ban on using gasoline for recreation or vacation travel? Would trucks be affected? Airplanes? Might it be necessary to limit the distance that we transport food and other items?

5. The President has asked you to develop an alternative to the automobile, one that does not use any gasoline or very little gasoline. What type of vehicle might this be? How will it be powered? How many passengers would it transport? Would special roads or rails be needed? Would it be difficult to convince people to use this vehicle? How might you convince them?
6. An industrial designer has recently designed an urban transportation system called the "Synchroveyer". It is basically a continuous train that has no beginning or end, resembling an endless loop or conveyer belt. All parts of a community can be serviced if several loops are put together. A loop can reach speeds of 30 miles an hour and stops at 40 to 90 second intervals. One can transfer from one loop to another when the two loops are traveling at the same speed. Design a synchroveyer system for your community or nearby city. Would such a system be useful in your community? In what ways might it be beneficial? What drawbacks might you find in such a system?
7. Imagine that by the year 2,000 people are earning higher incomes and working shorter hours. The widespread use of telecommunications has made it possible for businessmen to hold meetings with people in different places without leaving their offices. Cities have increased in size (90% of the population live in metropolitan areas) and are centers of industry, business and entertainment. How might this situation affect air transportation? Will there be differences in number of short trips and long trips? Would the amount of air travel decrease or increase? Who will be the major customers? Will airplanes be designed to carry more passengers and fly over longer distances?

   In your scenario describe some of the changes in air travel that you think might result. Do you think air travel will decrease or increase? What other new developments need to occur in order to bring about the change you predict?
8. Suppose that in the year 2020 mopeds became a major form of transportation. What types of changes might have to take place to allow for large numbers of mopeds? Will they simply replace autos on the roads or will special roads have to be built for mopeds? Shopping centers today are designed around the automobile; if they were designed with the moped in mind, would they need to be designed differently? Would the numbers of serious accidents be increased or decreased? Would different types of safety regulations need to be enacted?
9. Imagine that in the year 2,000 the number of automobiles has doubled, but no new major highways have been built. Traffic congestion in the major metropolitan areas has reached a point where workers driving to work often spend up to four hours in their cars just to complete a 30-mile round trip. As traffic commissioner of a large city you are assigned the task of developing a plan to reduce the massive congestion. What types of changes would your plan recommend? How might you convince people to adopt the recommendations?

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