National Aeronautics and
Space Administration
Langley Research Center

Educational Product	
Students	Grades 3-5

NP-2003-02-29-LaRC

ADVENTURES in aeronautics

with F.A.PLANE!

HEY KIDS!

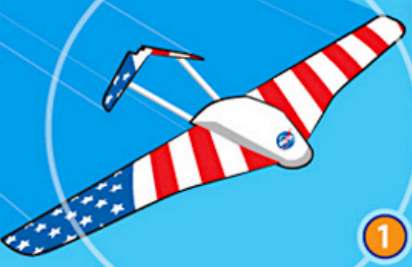
TAKE A TRIP WITH F.A. PLANE AND FRIENDS TO LEARN ABOUT THE FIRST "A" IN NASA, "AERONAUTICS!"

AERONAUTICS

The science of flight that deals with all types of aircraft.

This storybook about NASA Aeronautics is dedicated to all the future aviation professionals–the youngsters that are in school today. We hope this story will inspire them to learn more about the many aspects of flight and the many types of careers associated with the U.S. aviation industry.

MATCH GAME!



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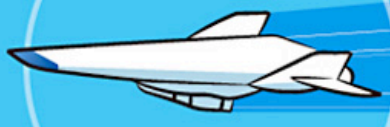

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6

These images are taken from pages in this storybook. When you have finished reading the book, come back to test your knowledge of these types of aircraft. Match the image of the aircraft with its name in the storybook. The names of the planes are listed below, choose the number of the image that fits its name!

- A Personal Air Vehicle
- B Joint Strike Fighter
- C Hypersonic X-43 Plane
- D Blended Wing Body
- E X-1 Supersonic Plane
- F Mars Plane

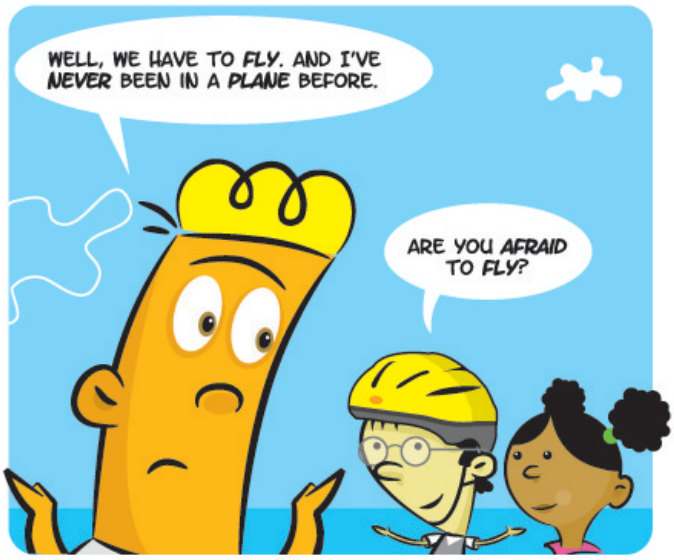
Acknowledgements

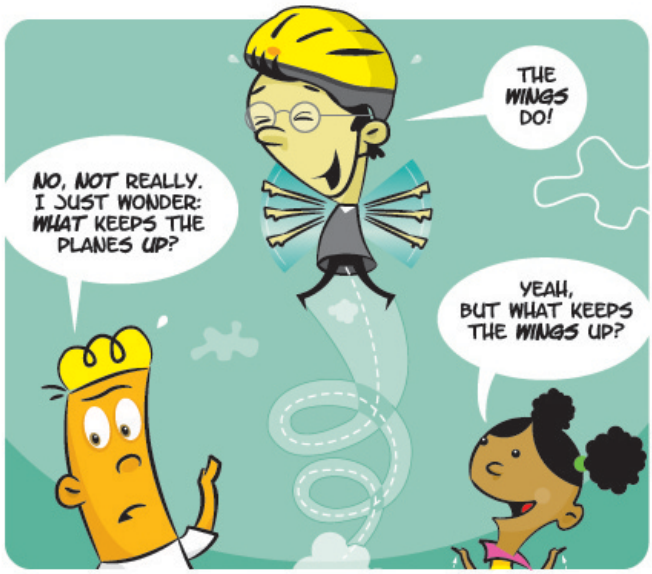
Original Idea & text for a museum storybook exhibit — Natalie S. Friend, Planners Collaborative Inc.

Illustrations & layout — Wade A. Mickley, NCI Information Systems

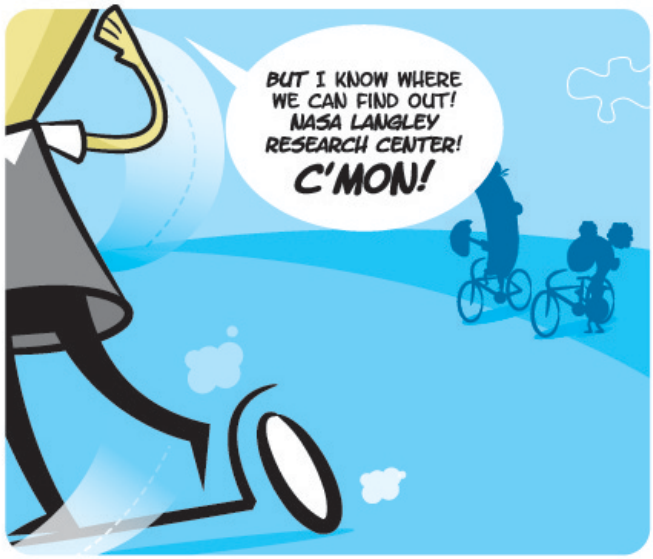
Answer key: A-2, B-5, C-4, D-6, E-3, F-1

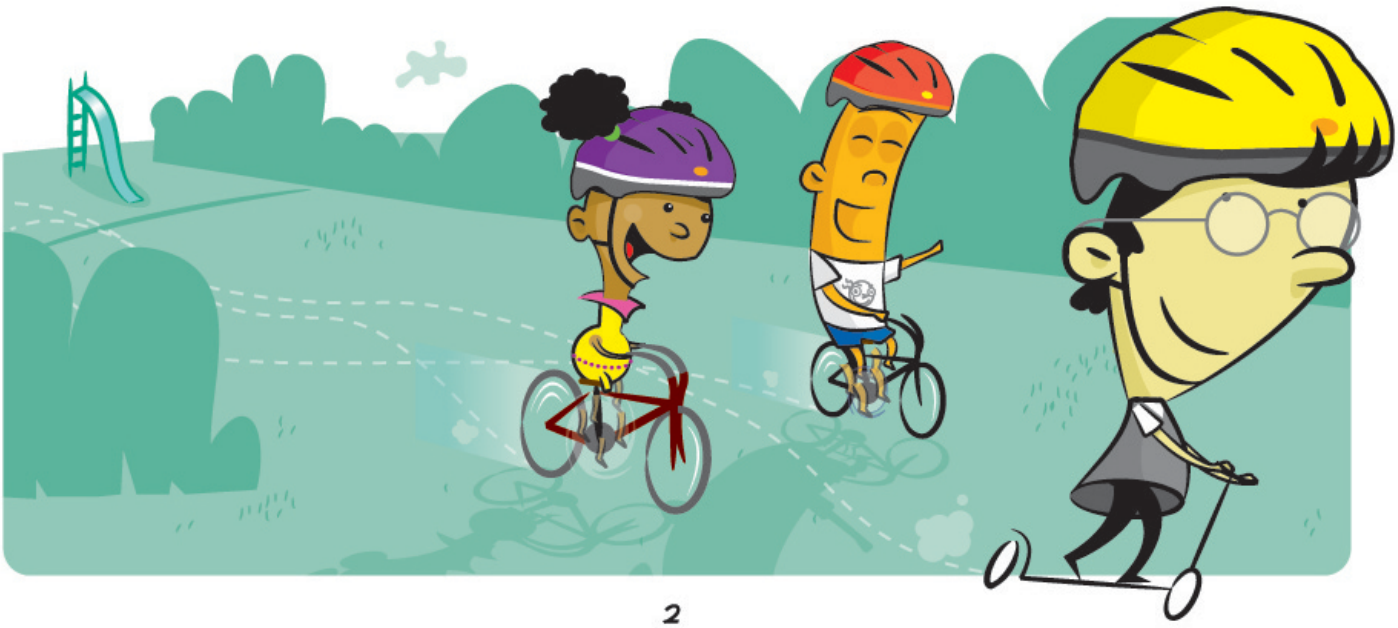

IT'S A SUNNY DAY IN HAMPTON, VIRGINIA.
IT'S MY GRANDMOTHER'S BIRTHDAY. SHE LIVES NEAR HONOLULU...
...SO WE'RE LEAVING TOMORROW.
WOW, ALL THE WAY TO HAWAII! WHAT A TRIP!
YEAH I GUESS SO.
NICKY, WHY THE LONG FACE?
HI ALEX. I WAS JUST TELLING KIM ABOUT OUR VACATION TO HAWAII.
DUDE, YOU DON'T LOOK HAPPY ABOUT IT.


WELL, WE HAVE TO FLY. AND I'VE NEVER BEEN IN A PLANE BEFORE.
ARE YOU AFRAID TO FLY?

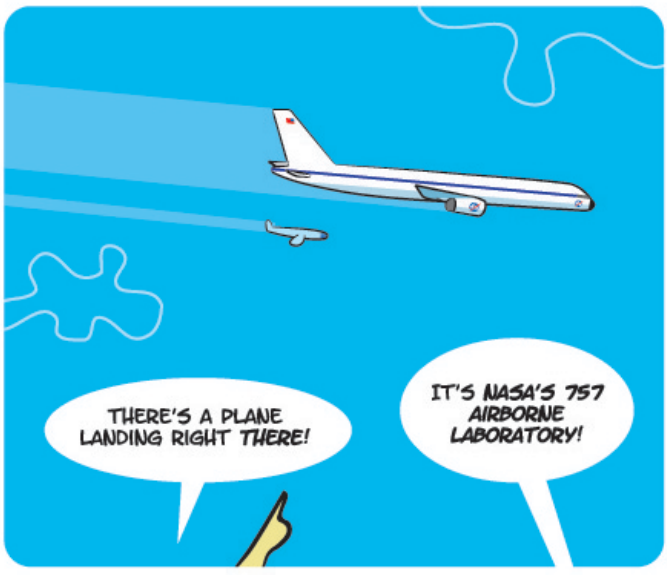

NO, NOT REALLY. I JUST WONDER: WHAT KEEPS THE PLANES UP?
THE WINGS DO!
YEAH, BUT WHAT KEEPS THE WINGS UP?

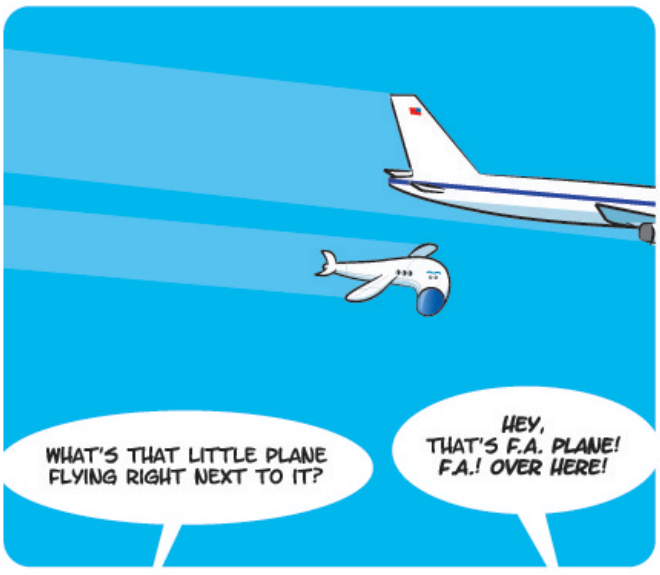

WELL, THE UH... THE WINGS STAY, UM...
SEE, YOU DON'T KNOW EITHER!

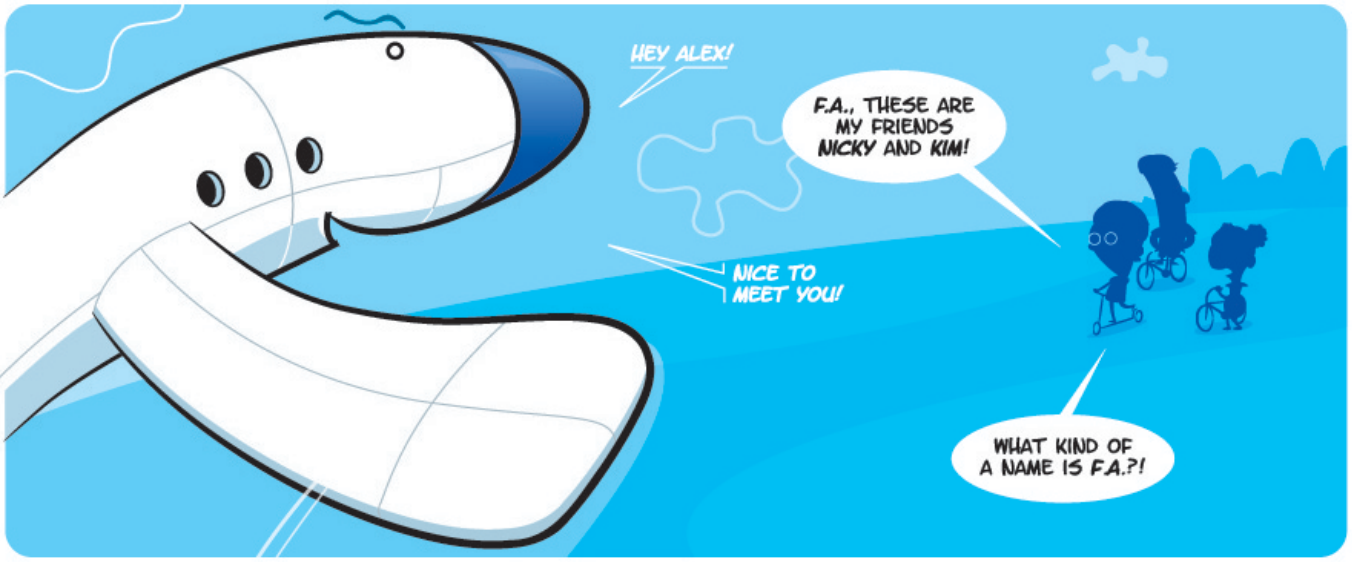

BUT I KNOW WHERE WE CAN FIND OUT! NASA LANGLEY RESEARCH CENTER! C'MON!

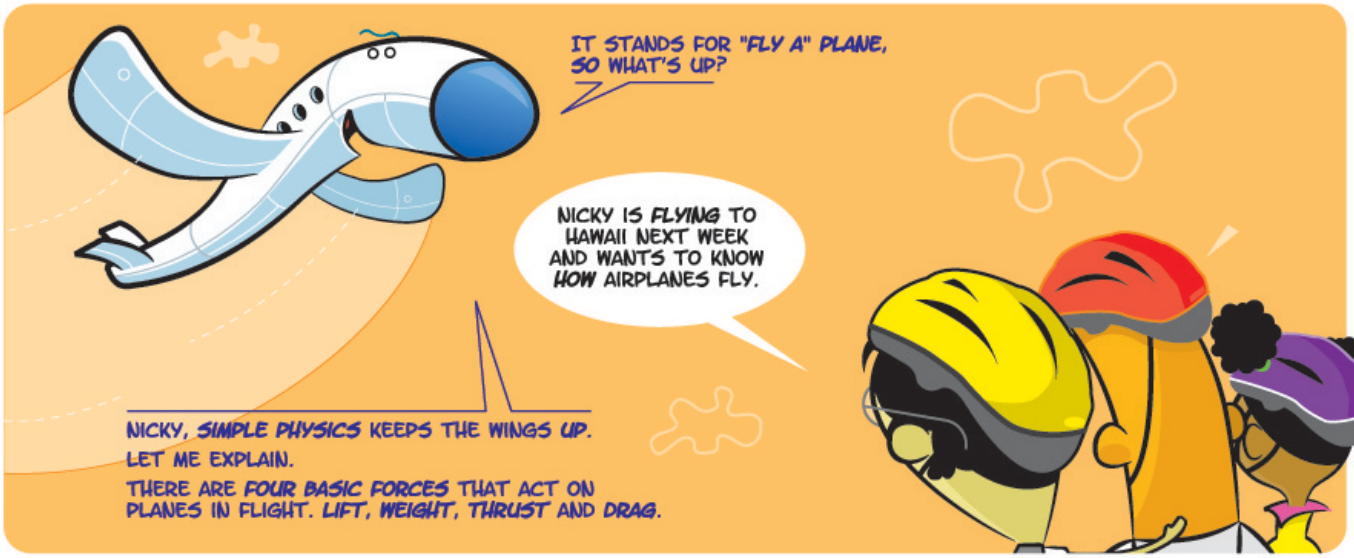


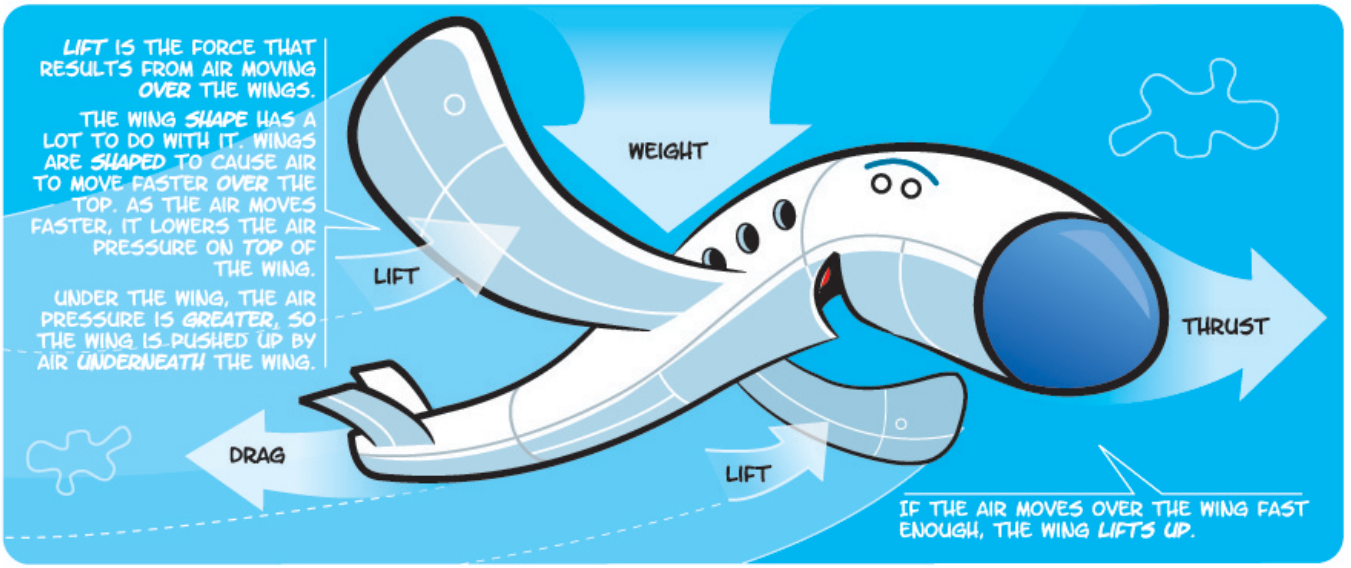

SHORTLY...
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER


THERE'S A PLANE LANDING RIGHT THERE!
IT'S NASA'S 757 AIRBORNE LABORATORY!

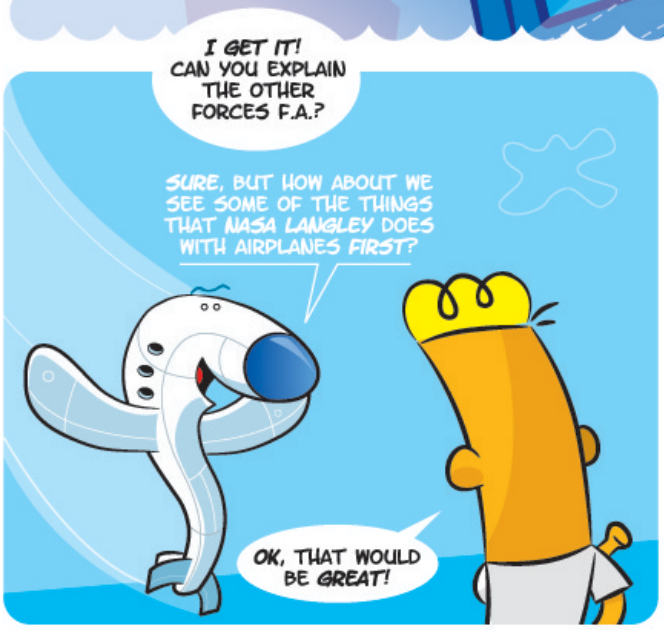

WHAT'S THAT LITTLE PLANE FLYING RIGHT NEXT TO IT?
HEY, THAT'S F.A. PLANE! F.A.! OVER HERE!

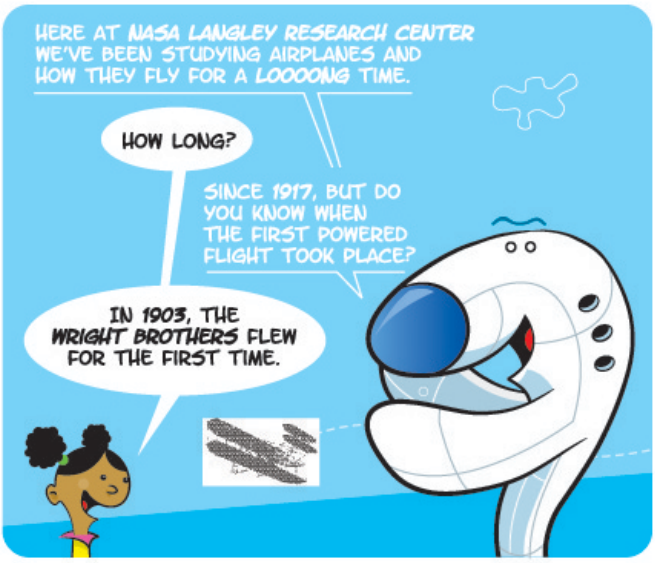

HEY ALEX!
F.A., THESE ARE MY FRIENDS NICKY AND KIM!
NICE TO MEET YOU!
WHAT KIND OF A NAME IS F.A.?!

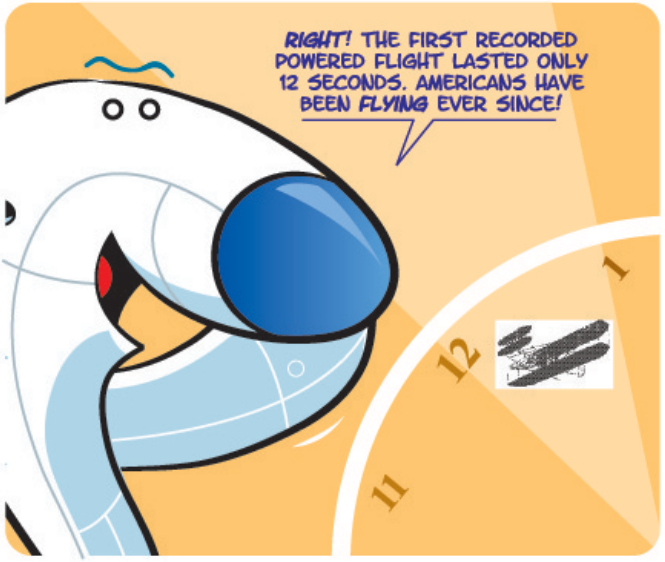

IT STANDS FOR "FLY A" PLANE, SO WHAT'S UP?
NICKY IS FLYING TO HAWAII NEXT WEEK AND WANTS TO KNOW HOW AIRPLANES FLY.
NICKY, SIMPLE PHYSICS KEEPS THE WINGS UP. LET ME EXPLAIN.
THERE ARE FOUR BASIC FORCES THAT ACT ON PLANES IN FLIGHT. LIFT, WEIGHT, THRUST AND DRAG.

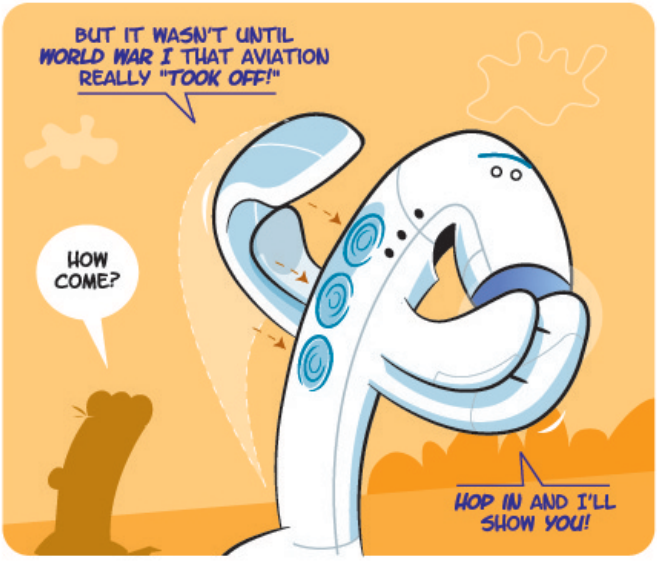

LIFT IS THE FORCE THAT RESULTS FROM AIR MOVING OVER THE WINGS.
THE WING SHAPE HAS A LOT TO DO WITH IT. WINGS ARE SHAPED TO CAUSE AIR TO MOVE FASTER OVER THE TOP. AS THE AIR MOVES FASTER, IT LOWERS THE AIR PRESSURE ON TOP OF THE WING.
UNDER THE WING, THE AIR PRESSURE IS GREATER, SO THE WING IS PUSHED UP BY AIR UNDERNEATH THE WING.
WEIGHT
LIFT
THRUST
DRAG
LIFT
IF THE AIR MOVES OVER THE WING FAST ENOUGH, THE WING LIFTS UP.

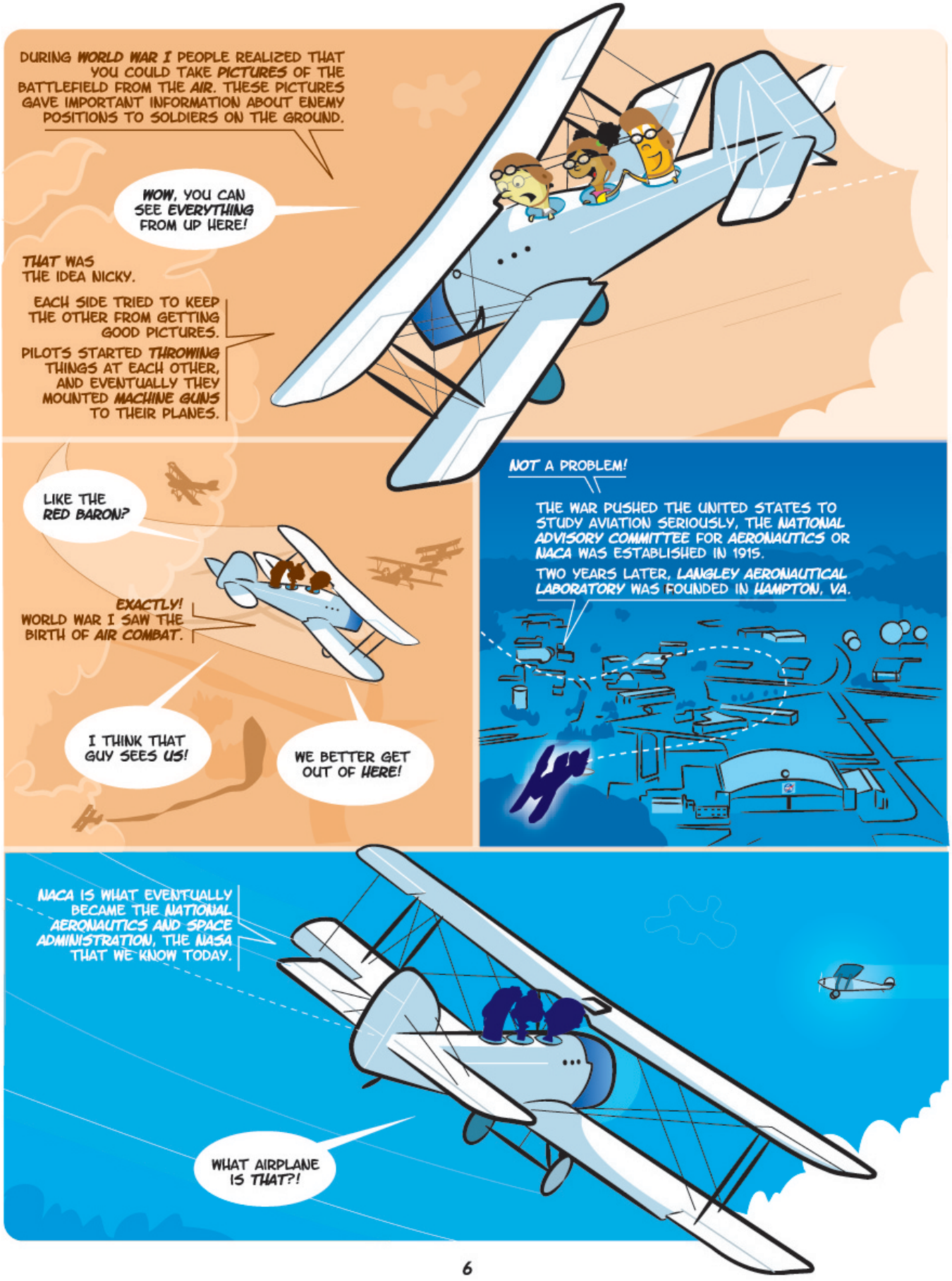

NICKY,
HAVE YOU EVER HELD YOUR HAND OUT OF A CAR WINDOW ON A TRIP?
DO YOU REMEMBER HOW YOUR HAND LIFTED UP AS THE AIR MOVED PAST IT? THAT IS SIMILAR TO THE FORCE THAT KEEPS THE WINGS UP--LIFT.

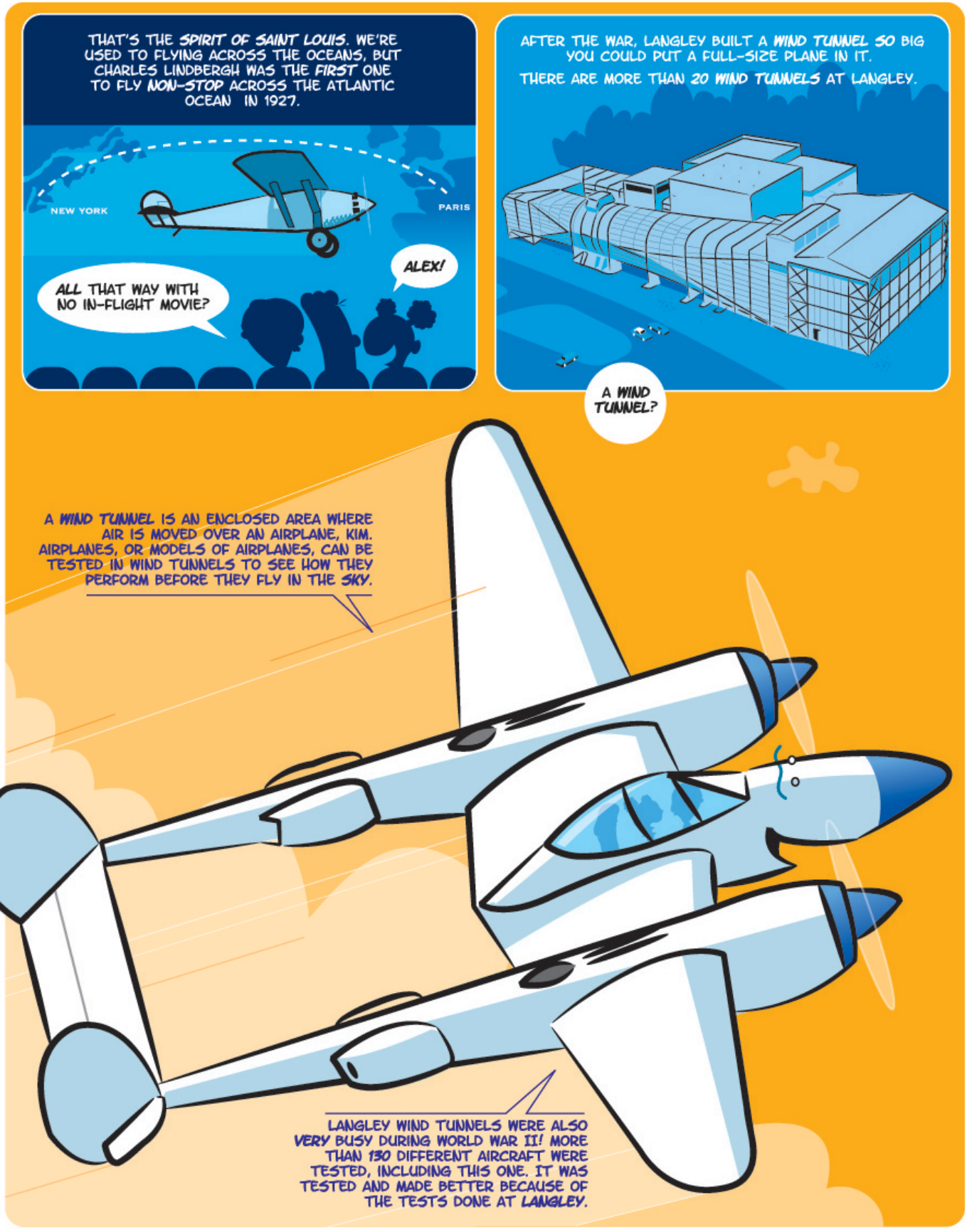

I GET IT! CAN YOU EXPLAIN THE OTHER FORCES F.A.?
SURE, BUT HOW ABOUT WE SEE SOME OF THE THINGS THAT NASA LANGLEY DOES WITH AIRPLANES FIRST?
OK, THAT WOULD BE GREAT!

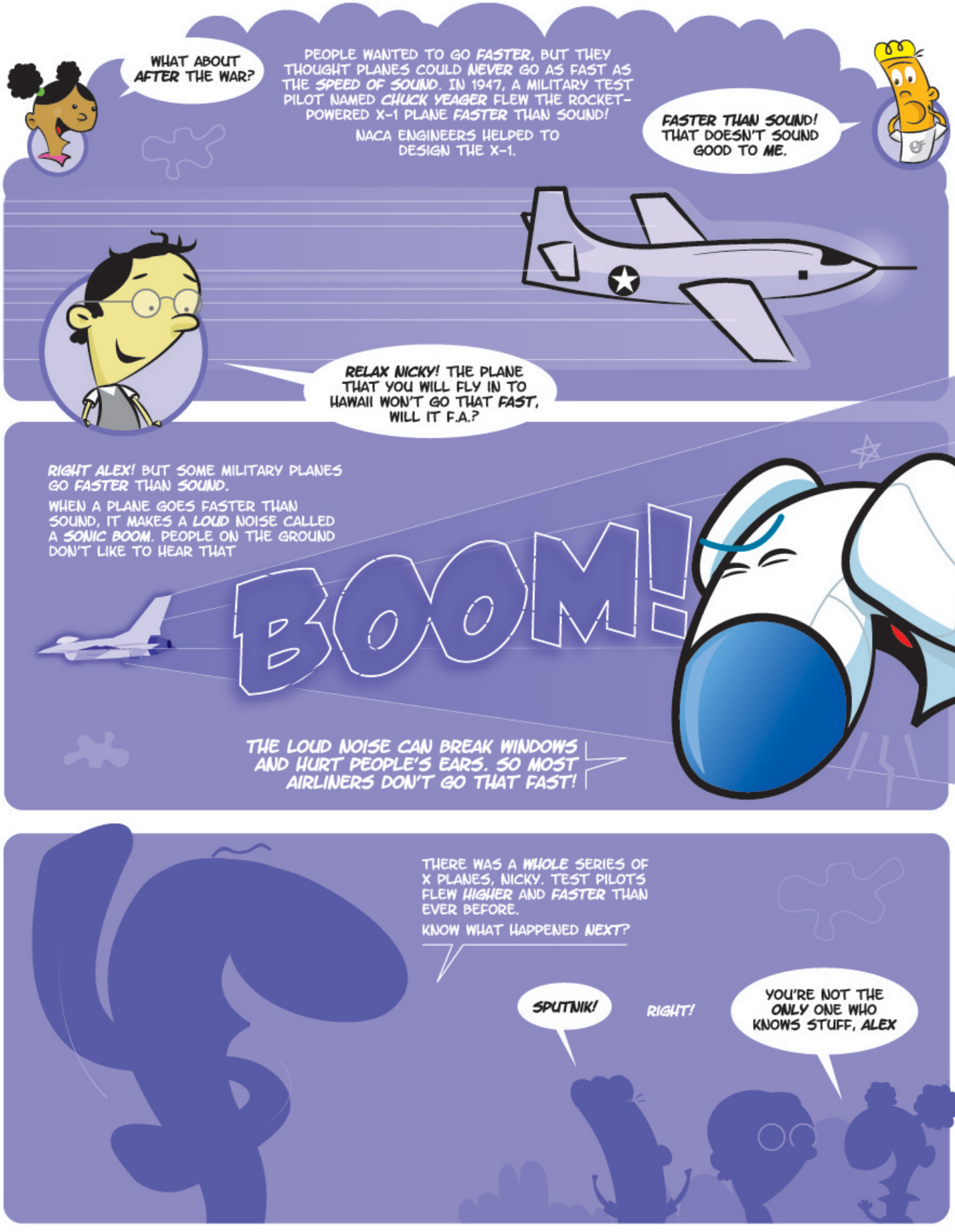

HERE AT NASA LANGLEY RESEARCH CENTER WE'VE BEEN STUDYING AIRPLANES AND HOW THEY FLY FOR A LOOOONG TIME.
HOW LONG?
SINCE 1917, BUT DO YOU KNOW WHEN THE FIRST POWERED FLIGHT TOOK PLACE?
IN 1903, THE WRIGHT BROTHERS FLEW FOR THE FIRST TIME.

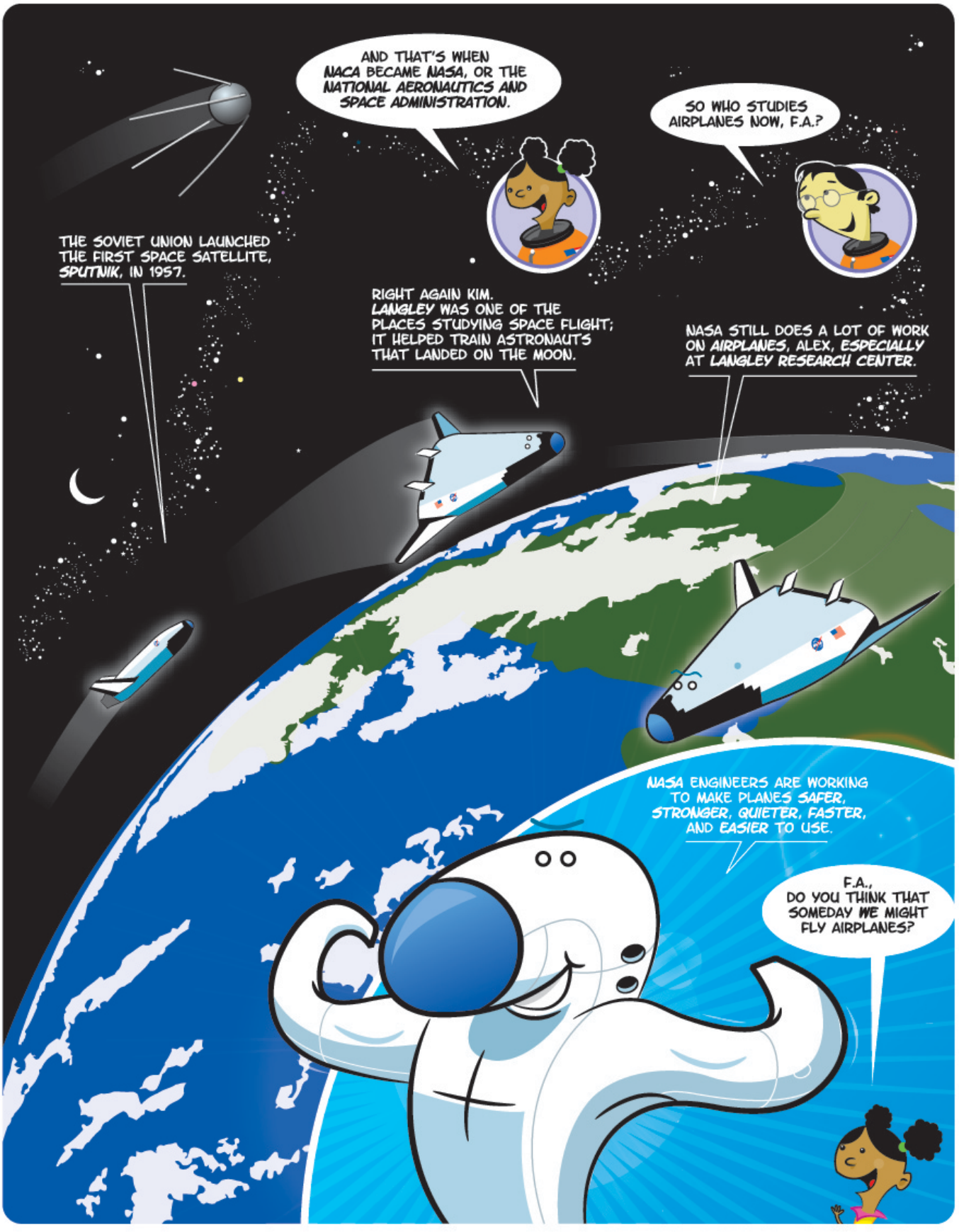

RIGHT! THE FIRST RECORDED POWERED FLIGHT LASTED ONLY 12 SECONDS. AMERICANS HAVE BEEN FLYING EVER SINCE!
1
12
11

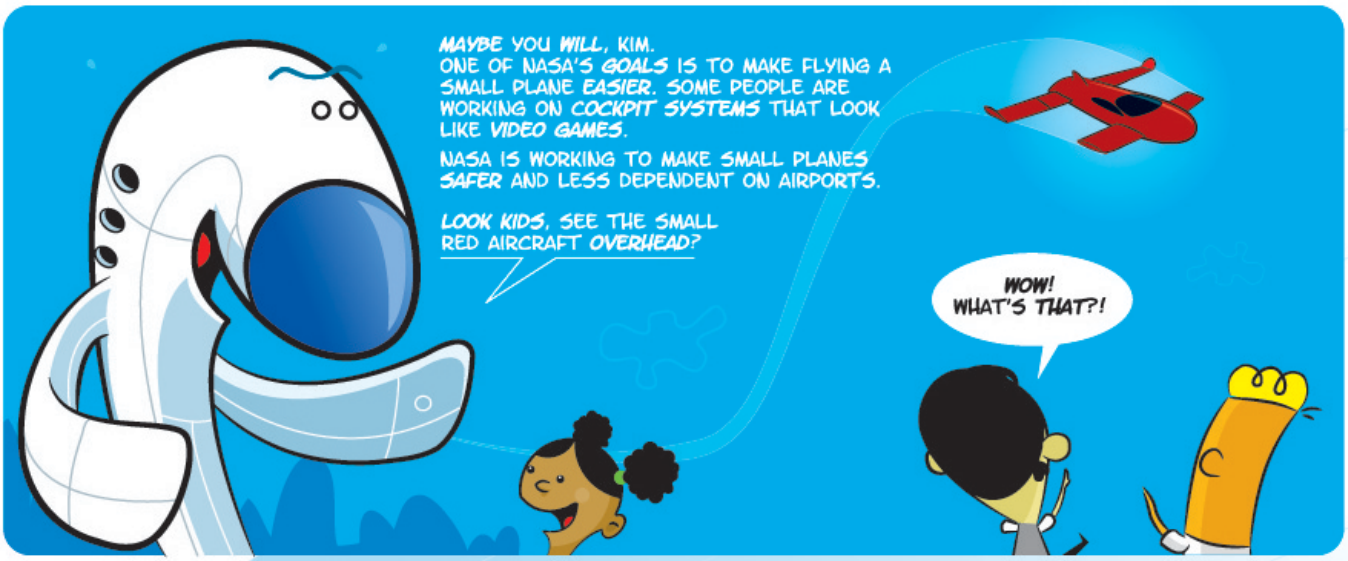

BUT IT WASN'T UNTIL WORLD WAR I THAT AVIATION REALLY "TOOK OFF!"
HOW COME?
HOP IN AND I'LL SHOW YOU!

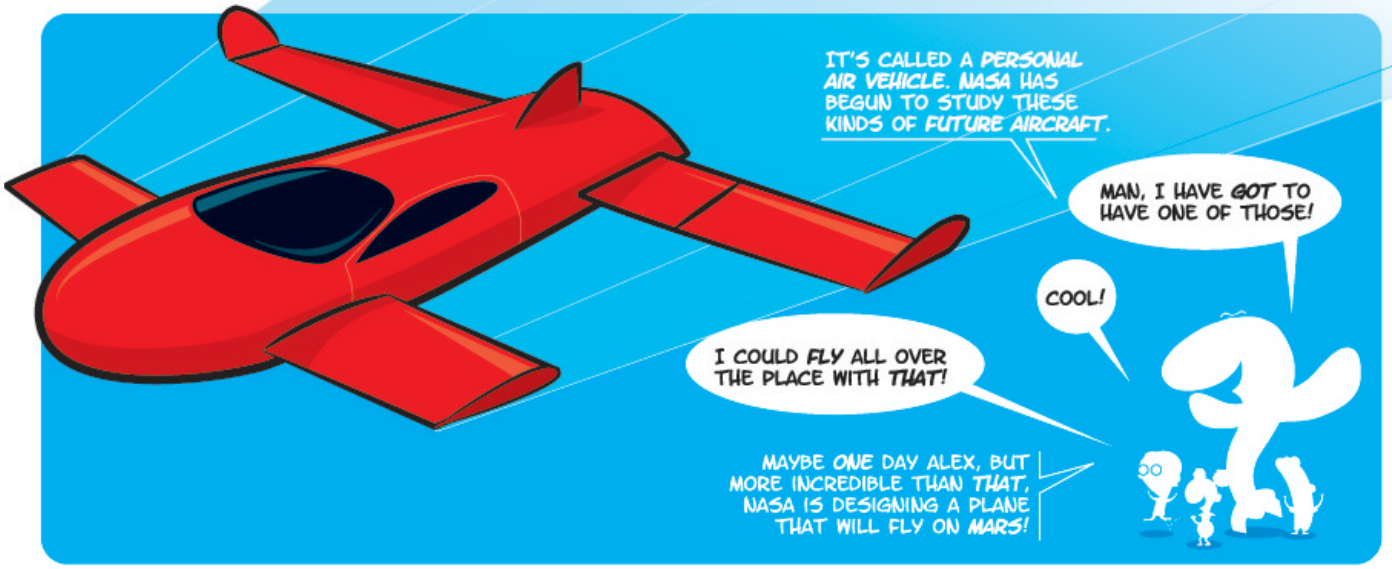

DURING WORLD WAR I PEOPLE REALIZED THAT YOU COULD TAKE PICTURES OF THE BATTLEFIELD FROM THE AIR. THESE PICTURES GAVE IMPORTANT INFORMATION ABOUT ENEMY POSITIONS TO SOLDIERS ON THE GROUND.
WOW, YOU CAN SEE EVERYTHING FROM UP HERE!
THAT WAS THE IDEA NICKY.
EACH SIDE TRIED TO KEEP THE OTHER FROM GETTING GOOD PICTURES.
PILOTS STARTED THROWING THINGS AT EACH OTHER, AND EVENTUALLY THEY MOUNTED MACHINE GUNS TO THEIR PLANES.
LIKE THE RED BARON?
EXACTLY! WORLD WAR I SAW THE BIRTH OF AIR COMBAT.
I THINK THAT GUY SEES US!
WE BETTER GET OUT OF HERE!
NOT A PROBLEM!
THE WAR PUSHED THE UNITED STATES TO STUDY AVIATION SERIOUSLY, THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS OR NACA WAS ESTABLISHED IN 1915.
TWO YEARS LATER, LANGLEY AERONAUTICAL LABORATORY WAS FOUNDED IN HAMPTON, VA.
NACA IS WHAT EVENTUALLY BECAME THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, THE NASA THAT WE KNOW TODAY.
WHAT AIRPLANE IS THAT?!

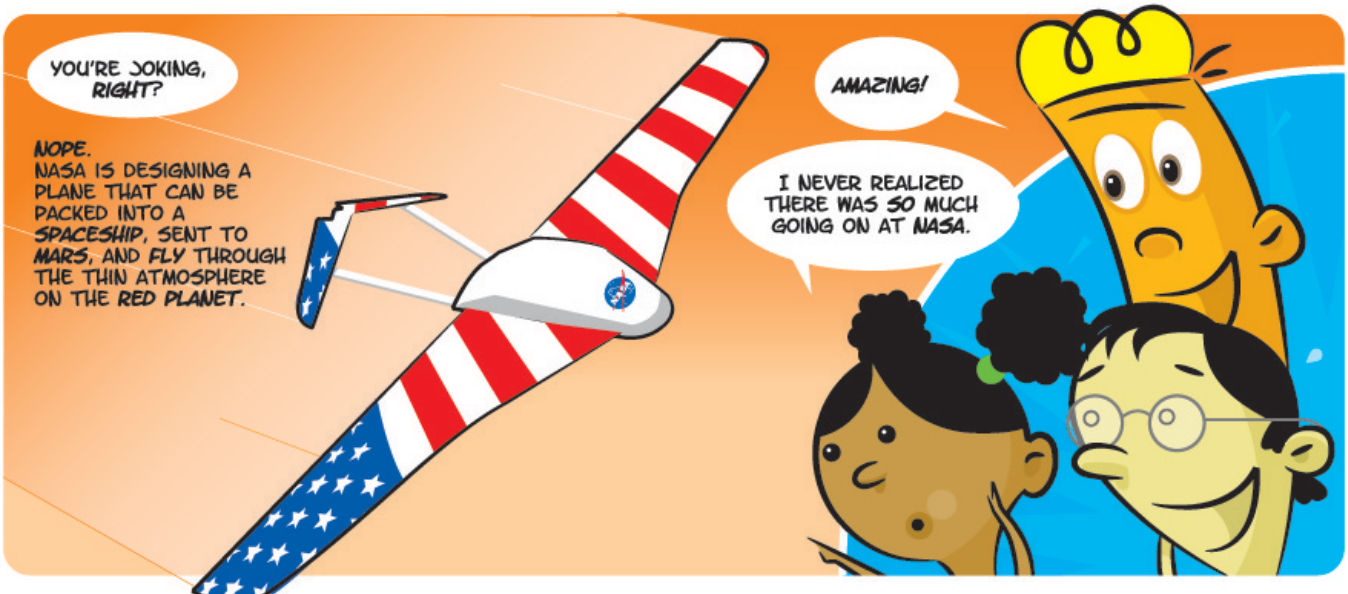

THAT'S THE SPIRIT OF SAINT LOUIS. WE'RE USED TO FLYING ACROSS THE OCEANS, BUT CHARLES LINDBERGH WAS THE FIRST ONE TO FLY NON-STOP ACROSS THE ATLANTIC OCEAN IN 1927.
NEW YORK
PARIS
ALL THAT WAY WITH NO IN-FLIGHT MOVIE?
ALEX!
AFTER THE WAR, LANGLEY BUILT A WIND TUNNEL SO BIG YOU COULD PUT A FULL-SIZE PLANE IN IT.
THERE ARE MORE THAN 20 WIND TUNNELS AT LANGLEY.
A WIND TUNNEL?
A WIND TUNNEL IS AN ENCLOSED AREA WHERE AIR IS MOVED OVER AN AIRPLANE, KIM. AIRPLANES, OR MODELS OF AIRPLANES, CAN BE TESTED IN WIND TUNNELS TO SEE HOW THEY PERFORM BEFORE THEY FLY IN THE SKY.
LANGLEY WIND TUNNELS WERE ALSO VERY BUSY DURING WORLD WAR II! MORE THAN 130 DIFFERENT AIRCRAFT WERE TESTED, INCLUDING THIS ONE. IT WAS TESTED AND MADE BETTER BECAUSE OF THE TESTS DONE AT LANGLEY.

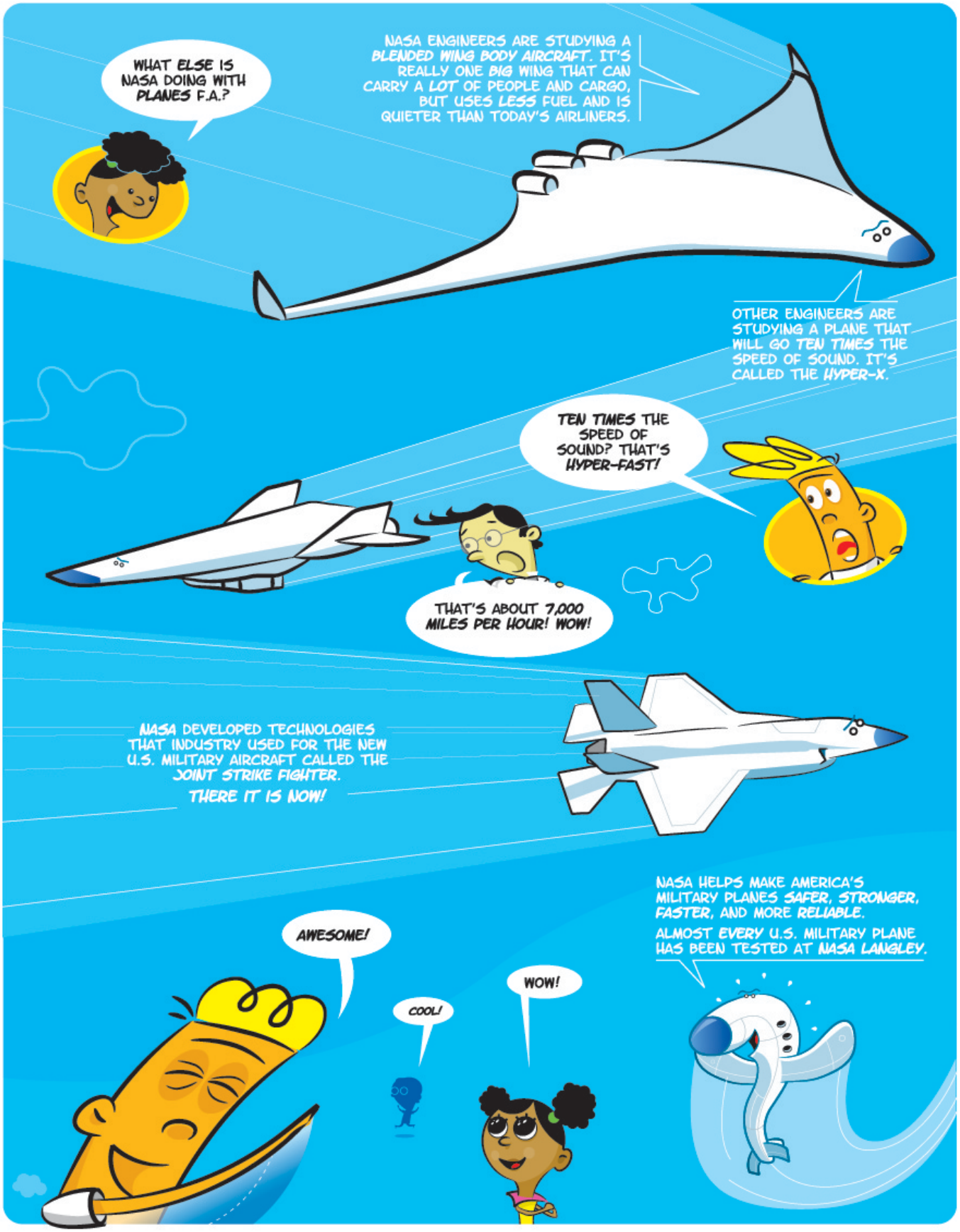

WHAT ABOUT AFTER THE WAR?
PEOPLE WANTED TO GO FASTER, BUT THEY THOUGHT PLANES COULD NEVER GO AS FAST AS THE SPEED OF SOUND. IN 1947, A MILITARY TEST PILOT NAMED CHUCK YEAGER FLEW THE ROCKET-POWERED X-1 PLANE FASTER THAN SOUND!
NACA ENGINEERS HELPED TO DESIGN THE X-1.
FASTER THAN SOUND! THAT DOESN'T SOUND GOOD TO ME.
RELAX NICKY! THE PLANE THAT YOU WILL FLY IN TO HAWAII WON'T GO THAT FAST, WILL IT F.A.?
RIGHT ALEX! BUT SOME MILITARY PLANES GO FASTER THAN SOUND.
WHEN A PLANE GOES FASTER THAN SOUND, IT MAKES A LOUD NOISE CALLED A SONIC BOOM. PEOPLE ON THE GROUND DON'T LIKE TO HEAR THAT
BOOM!
THE LOUD NOISE CAN BREAK WINDOWS AND HURT PEOPLE'S EARS. SO MOST AIRLINERS DON'T GO THAT FAST!
THERE WAS A WHOLE SERIES OF X PLANES, NICKY. TEST PILOTS FLEW HIGHER AND FASTER THAN EVER BEFORE.
KNOW WHAT HAPPENED NEXT?
SPUTNIK!
RIGHT!
YOU'RE NOT THE ONLY ONE WHO KNOWS STUFF, ALEX

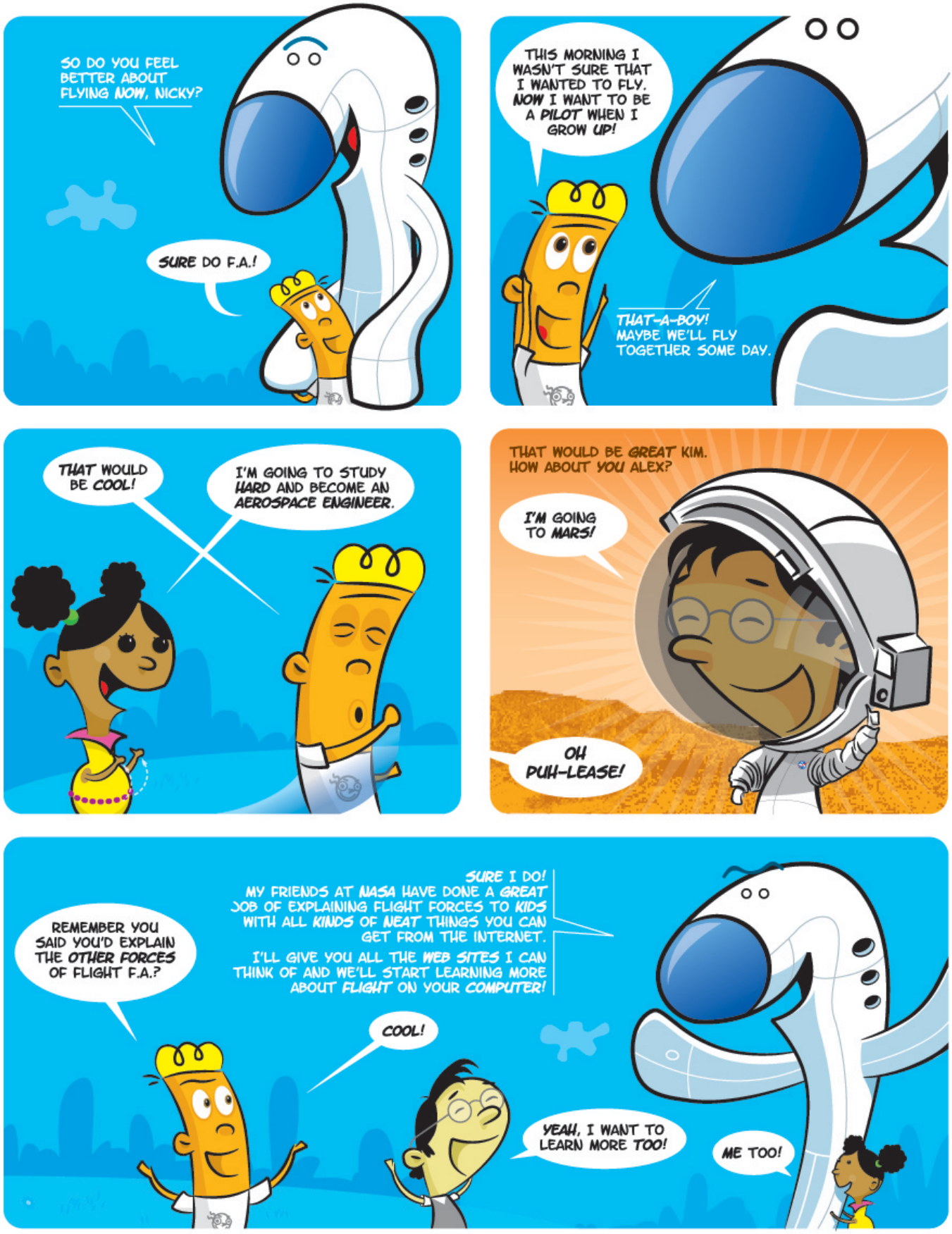

AND THAT'S WHEN NACA BECAME NASA, OR THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.
SO WHO STUDIES AIRPLANES NOW, F.A.?
THE SOVIET UNION LAUNCHED THE FIRST SPACE SATELLITE, SPUTNIK, IN 1957.
RIGHT AGAIN KIM. LANGLEY WAS ONE OF THE PLACES STUDYING SPACE FLIGHT; IT HELPED TRAIN ASTRONAUTS THAT LANDED ON THE MOON.
NASA STILL DOES A LOT OF WORK ON AIRPLANES, ALEX, ESPECIALLY AT LANGLEY RESEARCH CENTER.
NASA ENGINEERS ARE WORKING TO MAKE PLANES SAFER, STRONGER, QUIETER, FASTER, AND EASIER TO USE.
F.A., DO YOU THINK THAT SOMEDAY WE MIGHT FLY AIRPLANES?


MAYBE YOU WILL, KIM.
ONE OF NASA'S GOALS IS TO MAKE FLYING A SMALL PLANE EASIER. SOME PEOPLE ARE WORKING ON COCKPIT SYSTEMS THAT LOOK LIKE VIDEO GAMES.
NASA IS WORKING TO MAKE SMALL PLANES SAFER AND LESS DEPENDENT ON AIRPORTS.
LOOK KIDS, SEE THE SMALL RED AIRCRAFT OVERHEAD?
WOW! WHAT'S THAT?!


IT'S CALLED A PERSONAL AIR VEHICLE. NASA HAS BEGUN TO STUDY THESE KINDS OF FUTURE AIRCRAFT.
MAN, I HAVE GOT TO HAVE ONE OF THOSE!
COOL!
I COULD FLY ALL OVER THE PLACE WITH THAT!
MAYBE ONE DAY ALEX, BUT MORE INCREDIBLE THAN THAT, NASA IS DESIGNING A PLANE THAT WILL FLY ON MARS!


YOU'RE JOKING, RIGHT?
NOPE. NASA IS DESIGNING A PLANE THAT CAN BE PACKED INTO A SPACESHIP, SENT TO MARS, AND FLY THROUGH THE THIN ATMOSPHERE ON THE RED PLANET.
AMAZING!
I NEVER REALIZED THERE WAS SO MUCH GOING ON AT NASA.


WHAT ELSE IS NASA DOING WITH PLANES F.A.?
NASA ENGINEERS ARE STUDYING A BLENDED WING BODY AIRCRAFT. IT'S REALLY ONE BIG WING THAT CAN CARRY A LOT OF PEOPLE AND CARGO, BUT USES LESS FUEL AND IS QUIETER THAN TODAY'S AIRLINERS.
OTHER ENGINEERS ARE STUDYING A PLANE THAT WILL GO TEN TIMES THE SPEED OF SOUND. IT'S CALLED THE HYPER-X.
TEN TIMES THE SPEED OF SOUND? THAT'S HYPER-FAST!
THAT'S ABOUT 7,000 MILES PER HOUR! WOW!
NASA DEVELOPED TECHNOLOGIES THAT INDUSTRY USED FOR THE NEW U.S. MILITARY AIRCRAFT CALLED THE JOINT STRIKE FIGHTER.
THERE IT IS NOW!
NASA HELPS MAKE AMERICA'S MILITARY PLANES SAFER, STRONGER, FASTER, AND MORE RELIABLE.
ALMOST EVERY U.S. MILITARY PLANE HAS BEEN TESTED AT NASA LANGLEY.
AWESOME!
COOL!
WOW!


SO DO YOU FEEL BETTER ABOUT FLYING NOW, NICKY?
SURE DO F.A.!
THIS MORNING I WASN'T SURE THAT I WANTED TO FLY. NOW I WANT TO BE A PILOT WHEN I GROW UP!
THAT-A-BOY! MAYBE WE'LL FLY TOGETHER SOME DAY.
THAT WOULD BE COOL!
I'M GOING TO STUDY HARD AND BECOME AN AEROSPACE ENGINEER.
THAT WOULD BE GREAT KIM. HOW ABOUT YOU ALEX?
I'M GOING TO MARS!
OH PUH-LEASE!
REMEMBER YOU SAID YOU'D EXPLAIN THE OTHER FORCES OF FLIGHT F.A.?
SURE I DO! MY FRIENDS AT NASA HAVE DONE A GREAT JOB OF EXPLAINING FLIGHT FORCES TO KIDS WITH ALL KINDS OF NEAT THINGS YOU CAN GET FROM THE INTERNET. I'LL GIVE YOU ALL THE WEB SITES I CAN THINK OF AND WE'LL START LEARNING MORE ABOUT FLIGHT ON YOUR COMPUTER!
COOL!
YEAH, I WANT TO LEARN MORE TOO!
ME TOO!

NASA has many web sites that can help you to learn more about flight. Some are listed below and others can be found by doing a search on the web for the topic that interests you most!

Resources for Students and Educators of Grades K -12

Aerospace Technology Education Programs
http://www.aero-space.nasa.gov/edu/2aero.html

Aerospace Education Services Program (AESP)
http://www.okstate.edu/aesp/AESP.html

NASA Explorer Schools
http://www.nsta.org/explorerschools

NASA Student Involvement Program (NSIP)
http://www.nsip.net

NASA Explores
http://NASAexplores.com

NASA Educator Resource Network
http://spacelink.nasa.gov/ercn/

NASA Revolutionary Vehicles Student Competition
http://avst.larc.nasa.gov/competition.html

Other web sites that may interest all age groups

The NASA Home Page Address
http://www.nasa.gov

NASA's Education Home Page
http://education.nasa.gov

NASA Langley Research Center
http://www.larc.nasa.gov