



PipeWorks STEAM Initiative: Tools and Resources

Orgelkids Kit Guidebook for Chapters



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AMERICAN GUILD OF ORGANISTS

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S T E A M

SCIENCE

The key focus is on sound.

- Sound is caused by vibrations
- What is vibrating in the organ
- Percussion instruments (piano) versus wind instruments (organ)
- Relationship of pipe length to pitch
- Intensity of vibrations and volume
- Stopped pipes - using scientific principles to get the pitch of longer pipes with less materials
- Sound travels in waves—action can be seen in experiments with pans of water and tuning forks

TECHNOLOGY

For many centuries the pipe organ was the most complex piece of technology a town or village had access to.

- Hydraulis — the oldest “water powered” pipe organ. 3 inch keys, no stops
- Mechanical powered systems—including: innovations for wind supplies, trackers, key action and stops
- Electrical powered system innovations such as blower systems, detached consoles and sampled sound

ENGINEERING

Engineering involves the design and building of machines, structures and processes; in the words of an engineering professor, “engineering makes science useful at scale”.

- Keyboards
- Pedal boards
- Key actions
- Free reeds
- Swell boxes
- Pistons
- Tone wheels
- Memory Levels
- Speaker systems
- Musical Instrument Digital Interface (MIDI) capabilities

ARTS

Using the capabilities/ voices of the organ to create tone colors that express images; illustrate texts; imitate sounds of nature, emotions, and beauty.

- Accompany sporting events—starting with Roman times
- Supporting congregational singing
- Public entertainment—largest pipe organs built for public entertainment venues (Boardwalk Hall & Wanamaker organs)
- Solo or accompanying instruments in concert venues
- Home entertainment
- Music therapy (healing arts)
- Guide live events—commemorate public events, graduations, weddings, memorials

MATHEMATICS

The foundational concepts of the organ are built on the work of two Greek mathematicians.

- Pythagoras —5th century BCE: “...Pythagoras is attributed with discovering the a string exactly half the length of another will play a pitch that is exactly an octave higher when struck or plucked. Split a string into thirds and you raise the pitch an octave and a fifth. Split it into fourths and you go even higher...”
- Ctesibius, a Greek mathematician living in Alexandria, Egypt, who created the first pipe organ about 300 BCE, the Hydraulis. His work was built on Pythagoras’ discoveries. He determined the mathematical aspects of pipe construction (scaling) to produce various pitches.
- Pipe design
- Wind pressure
- Tuning



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This PDF includes clickable links throughout. Wherever you see the following underline style: website.com, clicking on the text will bring you to the corresponding website.

Preface

One of the key strategic goals of the AGO is to invest in the next generation of organists.

Orgelkids, an educational pipe organ program founded in the Netherlands, originated a traveling, reusable kit that empowers children to assemble a working 2-rank, 2-octave pipe organ. Orgelkids USA is quickly growing into a nationwide network, introducing the King of Instruments to young people and making the pipe organ, its heritage, culture, and music, accessible.

Whether your chapter already owns an Orgelkids kit or is considering obtaining one, this guidebook has been designed to provide you with a workplan and pathways your chapter can follow to successfully promote, demonstrate, engage, and increase the awareness of our profession and the organ to a younger group of prospective members. Examples of science projects that can be integrated into STEAM (science, technology, engineering, arts, mathematics) programs have also been included.

The Guild gratefully acknowledges the following individuals of the PipeWorks STEAM Initiative Advisory Council in the development of this guidebook:

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Funding and Fundraising

Fundraising is often a necessary requirement before purchasing an Orgelkids kit. If you and your committee don't always equate fundraising with "fun," here are some suggestions from AGO chapters that have been successful:

- Identify houses of worship in your area that desire to grow their youth attendance at services and engagement with special programs. Offer to present a special Orgelkids program for them.
- Is there a congregant in your house of worship who you know, who might fund or subsidize the purchase? Make sure that they know about Orgelkids and send them a special invitation to a demonstration.
- Contact various denominations for ecumenical grants to introduce Orgelkids at national, regional, and state-wide denominational music conferences.
- Reach out to other chapters in your area to determine if you can collaborate on the purchase of an Orgelkids kit.
- Seek community arts associations and corporate arts and education grants in your area, with an emphasis on how STEAM benefits the greater community.
- Once you have added an Orgelkids kit to your outreach repertoire, you may find the need for additional funding to cover the costs* of offering an Orgelkids experience in your local schools. One option is to target Title One schools in your area.

* potential costs might include bus rental and driver fees for field trips to full size organs and mini-concerts for the new organbuilders

WHAT IS TITLE ONE FUNDING AND HOW DOES IT WORK?

positiveaction.net/blog/title-1-school-funding

This website offers a ton of resources regarding requesting funding through your state, as well as where to seek private funding.

They also have a link about how to facilitate the creation of a grant :

positiveaction.net/grant-writing#program-description





Community Outreach

Before you receive your Orgelkids kit, begin by researching who you will want to contact once you receive the kit. Start by identifying schools and community organizations that would be good candidates for PipeWorks STEAM programs and begin to form contacts with these institutions:

- Public schools, including charter schools
- Religious academies
- School principals, music teachers, and science teachers and/or Parent Teacher Associations, to explain that you want to enhance their STEM programs to become STEAM programs, through the addition of arts and music to science, technology and engineering education. Through a hands-on demonstration of an Orgelkids Kit, students would actively be involved in assembling it and learning how all of the parts work together to create pipe music. Involve students in science experiments. **See Appendix A*
- Home schooling leaders and associations
- Local Music Teachers National Association (private teachers) and music education associations (school teachers) to explore combined events including Orgelkids.
- Inner city schools where there are no or minimal music programs, such as **Title One (bit.ly/title1A)** low income schools. You can search for schools near you **here (bit.ly/T1schools)**.
- Programs for older learners, such as continuing education/adult education
- Community programs and events, such as **Make Music Day (makemusicday.org)**, **Bach in the Subways (bachinthesubways.org)**, **Maker Faires (makerfaire.com/map)**.
- Public libraries (and don't forget local bookstores that also present programming)
- Museums, including county museums, history museums, children's museums, science and technology museums





Chapter Management

Once you have secured funding and ordered an Orgelkids kit, what comes next? While you are awaiting delivery, there are several logistical questions to answer:

■ What are the usage policies?

- Who will have permission to use the kit: chapter members, other chapters, individuals not in the Guild?
- Will you charge a rental fee?
- Will you ship it out of your area, if requested?
- Will you require a trained facilitator to accompany its use?
- How will those facilitators be trained?

■ Who will be the lead caretaker and outreach ambassador?

Hold yearly ambassador “training” and continually add creative new dimensions to your training.

■ How will we maintain the reservation calendar?

Will it be online, or will an individual keep it?

■ Where will the kit be stored?

Ideally, it should be stored and accessible from a geographically-central location. Will it be stored at a member’s home, or in a school or church?

■ Do we need insurance on our kit?

One insurance company known to offer policies for Orgelkids kits is Anderson Musical Instrument Insurance Solutions, LLC. (anderson-group.com), the company used by Orgelkids USA for their two organ kits. EPIC Insurance brokers epicbrokers.com also offers policies covering musical instruments.

■ Where will we do demonstrations?

Create a list of possible outreach venues to get the kit out into the community. Be creative.

■ How will we launch the STEAM program with our Orgelkids kit?

Plan a grand celebration in the chapter to introduce the kit. Make this a collaborative effort. Let everyone put it together and play it. Read the instructions first! The frame has to be assembled exactly and in the correct order. Be ready to schedule your first facilitator training session and sign people up.

■ How will we publicize the program?

Share information with your members on your website and in your newsletter, as well as through social media channels. Also, alert local media (newspapers, television and radio stations) about the program and upcoming demonstrations.





Promotion and Marketing

1. Organize a Pipes and Pinot or a Pipes and Punch Party.

Find someone willing to host a party and invite 15-20 friends. As guests arrive, please ask them to sign in and include their address and email. Having this information will be critical for fundraising. During the party, get everyone involved in building the Orgelkids kit. Discuss the potential of the kit and all of the opportunities where it can be presented. Ask for donations at the party and also inform them where they can donate. Consider using GoFundMe ([gofundme.com](https://www.gofundme.com)) such as the successful GoFundMe in Oklahoma: [gofundme.com/f/orgelkids-kit-for-oklahoma](https://www.gofundme.com/f/orgelkids-kit-for-oklahoma). Make sure you have brochures ready to hand out and have a follow up letter ready to send to everyone after the event.

2. Present an Orgelkids Recital that includes other instruments.

When searching for a venue, be sure to inquire if there is accessible technology to livestream the event and accept online donations.

3. Birthday Parties.

Promote the Orgelkids as entertainment for a birthday party. Ask for a donation. (Factor into the donation the amount of time it took for delivery and removal).





Using Your Kit

Whenever possible, travel with the kit. Below you will find examples of two ways to use the kit.

In preparing curriculum and presentations, make sure to use and provide age-appropriate texts, so that all ears and minds are enthused and engaged. Age-appropriate texts encourage return invitations, as students mature in their educational environment and awareness.

#1 In a workshop/ classroom setting

Divide the students into three teams so that each group will actively participate in building the kit.

- **Team 1** sorts pipes
- **Team 2** sorts the keys
- **Team 3** builds the frame

Then each team in turn, teaches the other groups what they just did and why it is important. Rotate the teams into new stations.

- **Team 1** lays the keys in the keyboard
- **Team 2** puts pipes in the toe board
- **Team 3** adds trackers to the windchest

Each team teaches the other groups what they just did and why it is important.

Final assignment: all teams gather at the main station, assemble trackers to keys and assemble wind and finish. This project can be accomplished in one hour. **This video** ([youtube.com/watch?v=5KMZKqFn-1g](https://www.youtube.com/watch?v=5KMZKqFn-1g)) shows the children enjoying what they've built and how to play the Orgelkids organ.

#2 In a Concert setting

A. CONCERT:

The organ should be *partially assembled*. The frame is built, most keys are laid, most pipes are seated, trackers are attached to the wind chest.

Concert order

- Play a couple of organ pieces
- Introduce Orgelkids and invite an audience member to connect trackers.
- As this is happening, play the next selection(s).
- Another audience member inserts remaining keys and pipes
- Play the next selection(s)
- Another audience member assembles the wind components and the kit is fully assembled.
- Play one or two pieces using the Orgelkids kit.
- Conclude the program and invite the audience to take a closer look.
- This video demonstrates how to build the kit during a concert: [youtube.com/watch?v=_FJU6E8tz6k](https://www.youtube.com/watch?v=_FJU6E8tz6k)

B. ALTERNATIVE CONCERT:

Play the first half of the concert as normal and children build the kit during the second half. (It also works better if the main instrument is located in a balcony!) **Build the kit activity** ([youtube.com/watch?v=xiigAshL16w&t=1s](https://www.youtube.com/watch?v=xiigAshL16w&t=1s))

#3

End with a Giveaway

At the end of your event, don't send your guests home empty handed! This is the perfect opportunity to send them home with a memento of their experience that also doubles as 1) an invitation to the next local organ concert and 2) provides a list of resources that will support their new interest in pipe organs. Send them home with a picture of them with "the organ they built" and a worksheet.

Here is an example of a **customizable worksheet** (bit.ly/AGOWorksheet):

Path of Wind in a Pipe Organ
Trace the path wind would take through this pipe organ by writing the order (#1-7) in the circled locations, starting with #1 where the wind begins.

Word Search

ORGANDIPAP
TRACKERSU
AEGTACTUS
ZSBELLOWS
EEANLJCXW
TRCOPKZAI
ZVHNVIBNP
FOOTEBPDDT
RIRFRAMES
ORPALLETST

Word Bank
pipes windchest keys
feeder bellows sliders
toe board trackers
reservoir bellows pallet box
tusk tenon joints mouths

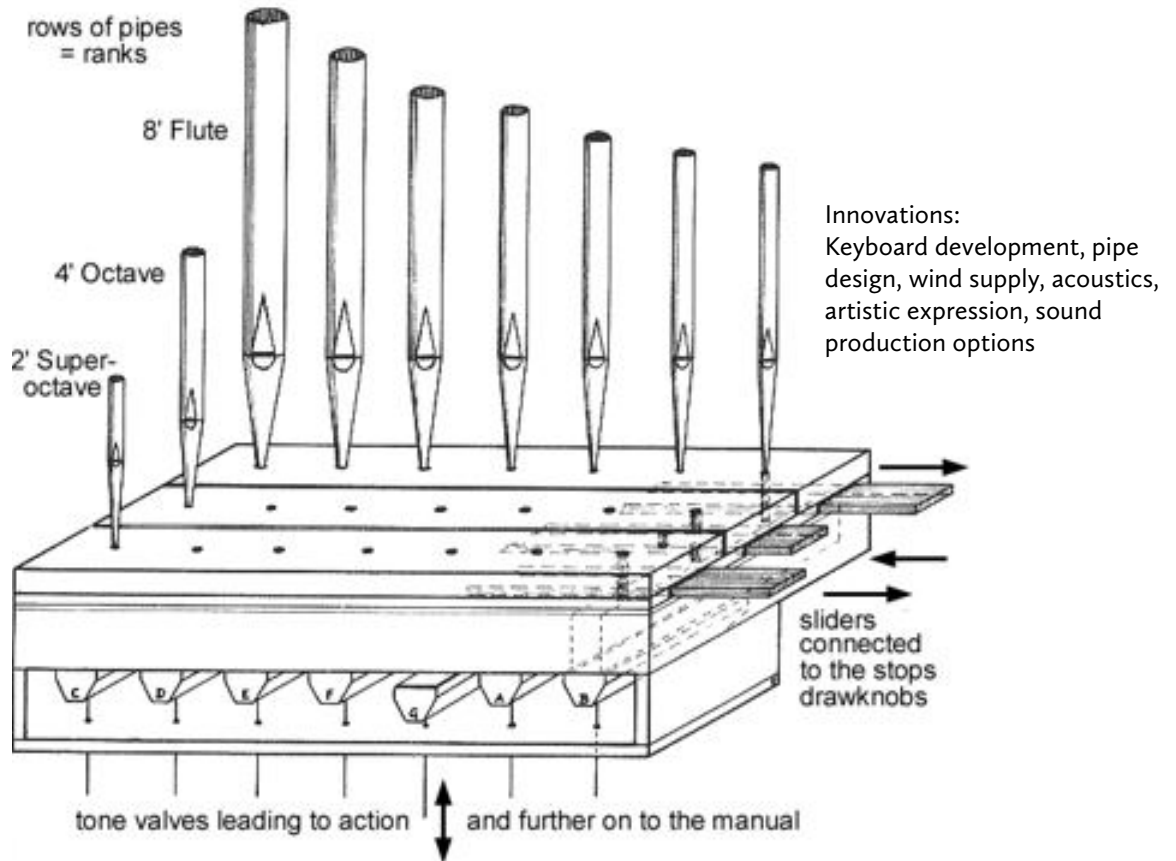
Parts of a Pipe Organ

Word List
ORGELKIDS BELLOWS FRAME TENON BACH
RESERVOIR CALCANT ORGAN FOOT TUSK
TRACKERS PALLET PIPES KEYS WIND

Now that YOU have built a pipe organ & know how they work, come check out a REALLY BIG organ in concert! We invite YOU to the next local organ concert: **FILL IN DETAILS HERE**



Gathering Steam...



ranks of pipe from: https://www.die-orgelseite.de/funktionsweise_e.html

SIGNIFICANT EVENTS IN ORGAN DEVELOPMENT:

~300 BCE	Water powered pipe organ invented by Greek Mathematician	1882	Thomas Edison develops technology to distribute electricity	1983	Musical instrument Digital Interface (MIDI) standards agreed
~480 CE	Likely last time the Hydraulis used in the Roman Coliseum	~1900	Theater organs introduced	2002	Hauptwerk sampled sound system using MIDI technology
~800	Organs introduced in the churches and promptly withdrawn	~1910	Electro pneumatic action introduced	2003	Carbon Fiber Trackers introduced by Fisk — Cathedral in Lausanne, Switzerland
~1200	Pipe organs introduced in churches in Europe	1910	Skinner American Symphonic Organ at Cathedral Church of St. John the Divine in New York City	2004	Walt Disney Concert Hall organ in Los Angeles opens with seismic design for earthquake protection
~1400	Oldest playable organ in Sion, Switzerland is built	1925	About half of U.S. population has access to electricity		
1700-1702	J.S Bach's earliest compositions in Lüneburg, Germany	1928	Electronic organs introduced		
1714	Gottfried Silbermann builds Freiburg Cathedral organ 3 manuals	1932	Midmer-Losh completes worlds largest pipe organ in Atlantic City		
1862	Cavaillé-Coll organ for St. Sulpice in Paris completed	1934	Hammond B ₃ (with tone wheels) introduced		
		1958	Flentrop organ at Adolphus Busch Hall, Harvard University		



STEAM Experiments

Science Projects

Have students participate in projects that demonstrate the science behind sound production by the organ:



Create an organ pipe.

(This comes from exploratorium.edu/snacks/organ-pipe but is incomplete here)

TOOLS AND MATERIALS:

- ☑ A large graduated cylinder of approximately 1-liter capacity.
- ☑ A 3 foot (1 meter) length of clear or opaque plastic pipe approximately 2" in diameter. Make sure that the pipe can slide freely into the cylinder. Thin walled PVC pipe works well and is inexpensive.
- ☑ A tuning fork. One is fine, however it's interesting to have others set to different frequencies.
- ☑ Water.



ASSEMBLY:

Stand the pipe on end and fill the cylinder with water. Strike a tuning fork and hold it so that its tines, vibrating in a vertical plane, are above and very near the end of the pipe. See Figure A.

As the fork continues to vibrate (strike again, as needed) move the pipe upward to find other loud spots. Repeat the procedure with different tuning forks of different frequencies and compare results.

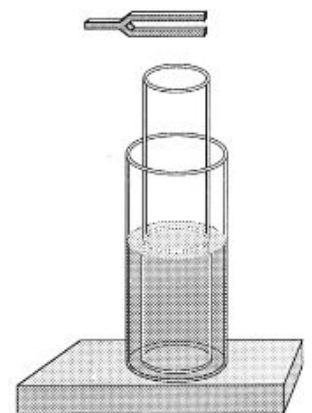


Figure A.



Demonstration of the Hydraulis

How the ancient water powered organ worked

This lesson explains how the oldest pipe organ from around 300 BCE worked, it also helps students understand the technological components that have remained the same in pipe organs since that time through today, and to illustrate not only how technology evolved as well as how the uses of the organ evolved.

TOOLS AND MATERIALS:

Most of the materials required can be readily obtained from local sources. Organ pipes are available, generally free for the asking, from local organ repair shops or organ builders. So here is the list of materials needed to complete this demonstration.

- Bucket
- Plastic bottle top
- Flexible plastic tubing
- Organ pipes — see note above

PREPARATION FOR THE DEMONSTRATION:

(You will want to practice this in advance)

Step 1: Align one end of the flexible plastic tubing with the bottle top. After these are aligned, secure these to each other with duct tape to prevent air leaks.

Step 2: Fill the bucket with water — about 2/3 full

Step 3: Slide an organ pipe into the other end of the flexible plastic tubing. Hold your hand over the space where the organ pipe meets the flexible hose to prevent air leaks

Step 4: Plunge the plastic bottle top into the water to send a vibrating column of air up the plastic tubing to force air into the organ pipe to create sound. Try variations with rapid, staccato movements with the bottle top to hear repeated notes. Try different organ pipes to illustrate different tone colors.

VIDEO OF DEMONSTRATION:

View a video of the demonstration showing the sound created by the plastic bottle top and tubing:

Video of Pumping Action (bit.ly/pumping-action)



This is an image of Hydraulis, the water powered organ, as it existed in Roman times.

This image came from the British Museum website and shows what the Hydraulis, or ancient water powered organ looked like in Roman times. The first pipe organ was designed and built by Ctesibius, a Greek mathematician living in Alexandria, Egypt. He later became known as the “father of pneumatic air systems”. The first pipe organ was built about 300 BCE. The first person Ctesibius taught to play the organ was his wife; women have been playing the organ since it was first invented. The Romans spread the pipe organ all over their empire. They used it for two purposes: to march troops into battle, and to rev up the crowds at sporting events, and at the Coliseum. In the chest below the pipes there would be canisters, three blocks of wood, which simulate the width of the early organ keys which were three inches wide. The valve mechanisms were so stiff that the instruments were played by striking the keys with one’s fists — very much like using the batons on a carillon. While the key size and touch, mechanical and electrical assists have all improved technologically over time, one thing remains the same: all pipe organs still have three basic components: keys, pipes, and a wind supply.

PROJECT #3

Sound Waves and Vibrations: Tuning Fork Splash Session

This lesson has two learning objectives: First, that sound is caused by vibrations, and second, that sound travels in waves. In relation to the organ, which is a wind instrument, sound is caused by vibrating columns of air of various lengths. This is in contrast to a piano where sound is caused by vibrating wire cords of various lengths.

TOOLS AND MATERIALS:

Tuning Fork Splash (for each group)



- Tuning forks
- Pie pans filled almost full with water
- Paper towels (for mopping)
- Pitcher for pouring water
- Table for multiple students to work together in groups

1. Demonstrate how the tuning fork works: Start by having the students hold the tuning fork to their ear without striking it on a hard surface like the edge of the table. Note that we don't hear anything. That's because nothing is vibrating. Next, have the students strike the tuning fork on the edge of the table and then hold it to their ears. Now we hear a sound because the tuning fork is vibrating.

2. Demonstrate how sound travels in waves: Start with the tuning fork not vibrating (may need to dampen the vibrations by holding to your chest). Dip the tuning fork in water and note that nothing happens. Now ask students if they think they can see a sound wave in action. Strike the tuning fork on the edge of the table to cause it to vibrate. Place the vibrating tuning fork in the pan of water and note how the movement of the sound wave pushes the water out of the pan.



3. Repeat so all students in the class can experience the lesson.



APPENDIX A:

For links to videos, websites and curriculum resources visit:

agohq.org/pipeworks-steam-initiative



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