
The airplane as an open source invention

Peter B. Meyer,
U.S. Bureau of Labor Statistics*

Cliometric Society session at ASSA meetings
New Orleans, Louisiana,
Jan 4, 2008

* Findings and views are those of the author, not the Bureau of Labor Statistics

Development of the airplane

- 1860s Aeronautical clubs and journals start in Britain and France
(a niche activity -- hopeless, useless, and/or dangerous)
- 1894 Survey book by Chanute
- 1903 Wright brothers' powered-glider flight
- 1909 An industry exists

Many designs shared openly, as in open-source software
-- but not simply replicated as in software

Unlike open-source software, it develops slowly.

We can see it evolve, in documents and visible designs.

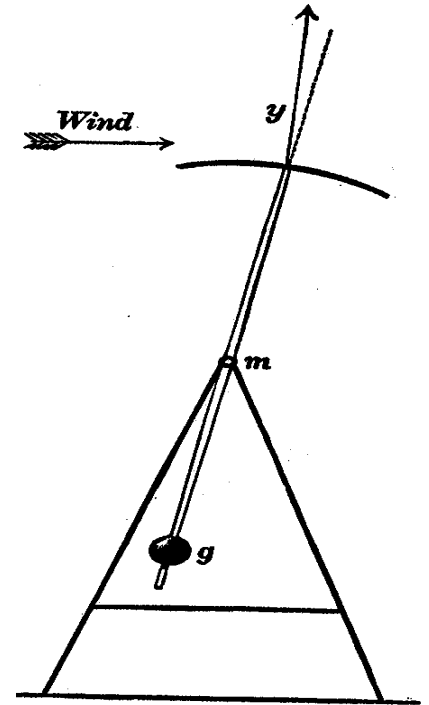
Otto Lilienthal

- Founded company making steam engines
- 1860s-80s studied bird wings and experiments
- 1889: published *Birdflight as the Basis of Aviation*
- 1891-6: Flew inspirational hang gliders
- 1896: Died after crash.

Motivation:

“... to soar upward and to glide, free as the bird”
-- Otto Lilienthal, 1889

“The glory of a great . . . invention . . . destined to benefit humanity [seemed] dazzling. . . .
Enthusiasm seized [us] at an early age.”
-- Gustav Lilienthal, 1912



Samuel Langley

Professor, then Director of Smithsonian Institution in DC

Tested lift and drag of planes on “whirling table” with 30-foot arm

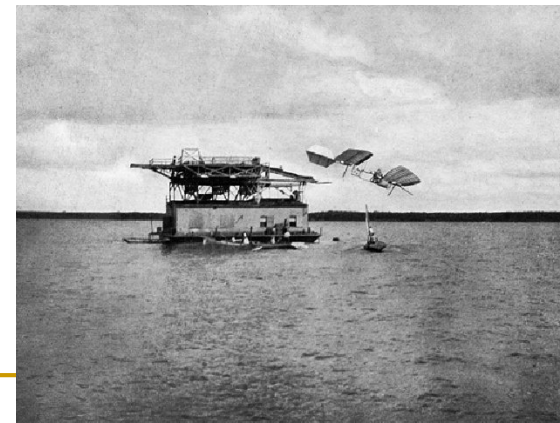
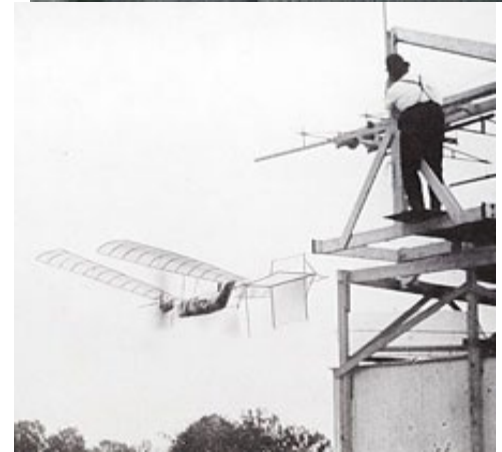
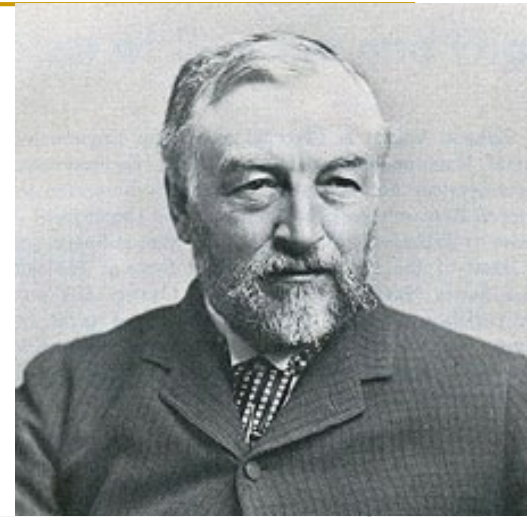
1891: Published *Experiments in Aerodynamics*

Wrote to and visited other experimenters

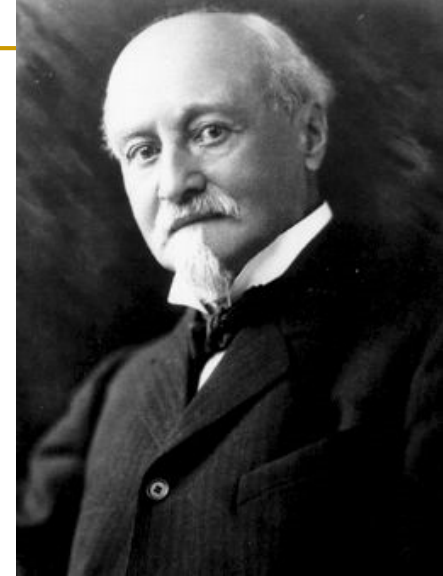
Helps make aviation study legitimate

1896: Small powered gliders flew half a mile.

1903: Aircraft carrying a person crashed



Octave Chanute



Chicago railroad engineer

1880s: takes interest in flying machines

1894: Publishes *Progress in Flying Machines*,
which surveyed experiments, devices, theories

1896 and on: ran experiments on gliders

Corresponded with, supported, visited many experimenters

Chanute preferred findings to be shared so as to speed progress

“[By writing lucid articles], personal correspondence, and visitation, he inspired and encouraged to the limits of his ability all who were devoted to the work.”

--Wilbur Wright, 1911

Chanute's 1894 overview *Progress in Flying Machines* refers to or quotes more than 190 persons

Experimenter / group	Pages	location (background)
Maxim	33	Britain (US)
Lilienthal	31	Germany
Penaud	22	France
Mouillard	21	Algeria, Egypt (Fr)
Hargrave	19	Australia (Br)
Moy	19	Britain
Le Bris	17	France
Langley	16	US
Wenham	15	Britain
Phillips	14	Britain

This activity is international.
References in aviation histories
appear to match Chanute's list

Most cited in index of <i>Published Writings of the Wright Brothers</i> (Jakab & Young, 2000)	
Person	pages
Lilienthal	34
Langley	29
Chanute	24 ₆

Patent counts tell different story

Hundreds of fixed-wing flying machine patents were filed before 1903 even excluding aerial balloons and internal-combustion engines.
[Data: Simine Short and Otto-Lilienthal Museum]

Few were by the people on Chanute's list.

Chanute, the Wrights, and historians treat these patents as irrelevant.

Not clear any fixed-wing patent earned any money before 1903.

➔ Intellectual property not relevant to this invention process

Parallels to open source software

- Autonomous innovators (not hierarchy, not cult)
- Sharing technical info in public space – including failure
- Intellectual property set aside
- Diverse objectives (notably intrinsic, altruistic ones)
 - Want to use the technology (want to fly!)
 - Curious, interested in the problem
 - Hope for recognition and prestige
 - Make people better off (bring peace, or make own nation safer)
- Internationally dispersed collaboration
- Role for moderator / evangelist / supporter

Alternative processes of invention: race to be first (space race);
know-how trading, collective invention, R&D for profit, user innovation;
Incentive to signal to employers, license a patent or start a product line

Micro-economic model

- Imagine self-motivated **tinkerers** with some project
“progress” is rewarding to them in future (in utility function)
→ They’d use time, effort, money for experiments
- Imagine their experiments have some value to one another
- Assume they cannot see how a marketable product would arise
→ They’d share findings with other tinkerers
→ Moderator/evangelist role arises naturally
→ They’d be willing to **specialize** to avoid duplication
→ They’d be willing to **standardize** design and tools
Market processes are not necessary for these effects
→ They prefer not to bother with intellectual property

Wright brothers as open-sourcers 1900-1902

Wilbur and Orville Wright ran a bicycle shop.

They read up on gliders and try flight experiments.

- Motivations:

"I am an enthusiast . . . I wish to . . . add my mite to help on the future worker who will attain final success." -- Wilbur Wright, 1899

"At the beginning we had no thought of recovering what we were expending, which was not great . . ." -- Orville Wright, 1953

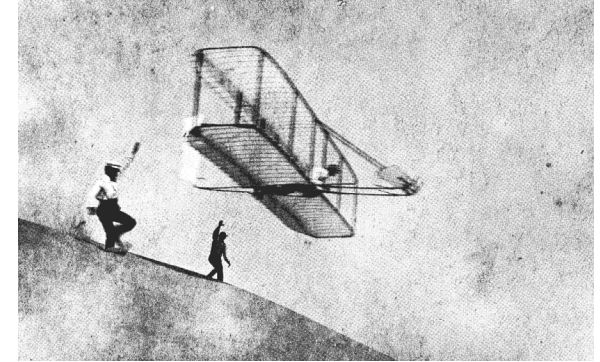
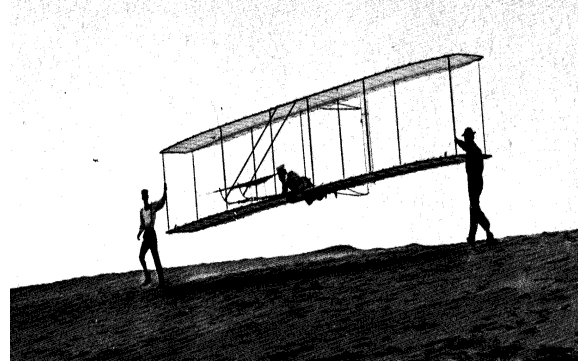
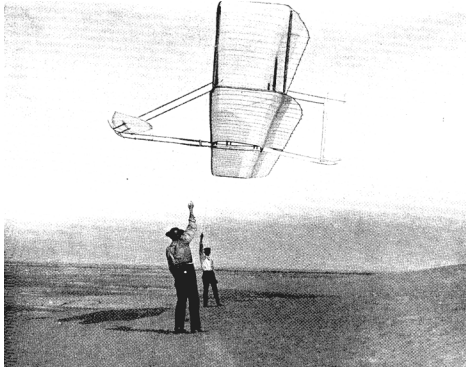
- They exchanged hundreds of letters with Chanute
- They published articles
- They spoke at conferences
- Were visited by Chanute and others

Wrights help test Octave Chanute's glider, Oct 1902



Wright methods and inventions

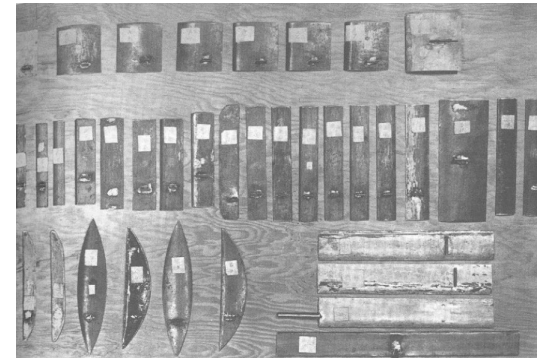
They are skilled, precision-minded toolsmiths, in a workshop every day.



They flew craft as kites and gliders both, many times

No landing gear, no engine. Their piloting invention had to be learned, like on bicycle

- Wind tunnel with smooth air flow
- Tested many wings systematically



- Propeller invention: shaped like wings, with lift going *forward*
- This produces ~40% more pulling power. This idea last to the present.

They exit the open-source network

Late 1902: they become more secretive, apparently because of wing design success

Early 1903: They filed for a patent on their control mechanism for the wings.

Their secrecy and tight hold on patent rights lead to permanent conflicts with Chanute, Curtiss, and others.

Micro model can incorporate a probability of exit.



First powered, controlled
fixed-wing flight
Dec, 1903

Implications

- Hard problems can be addressed this way
- Experimentation helps, if one cannot foresee the end product
- New industries arise this way
- Self-motivated innovators can be hobbyists, “skunkworks” participants, basic researchers
- Can be sped up by networking, or slowed by restrictions
- Theoretical implication: Models of employees, managers, investors and consumers cannot replicate this observed phenomenon. We must have “tinkerers” to get modern growth and industry.