

# **Remote Sensing and its Current Status in Society**

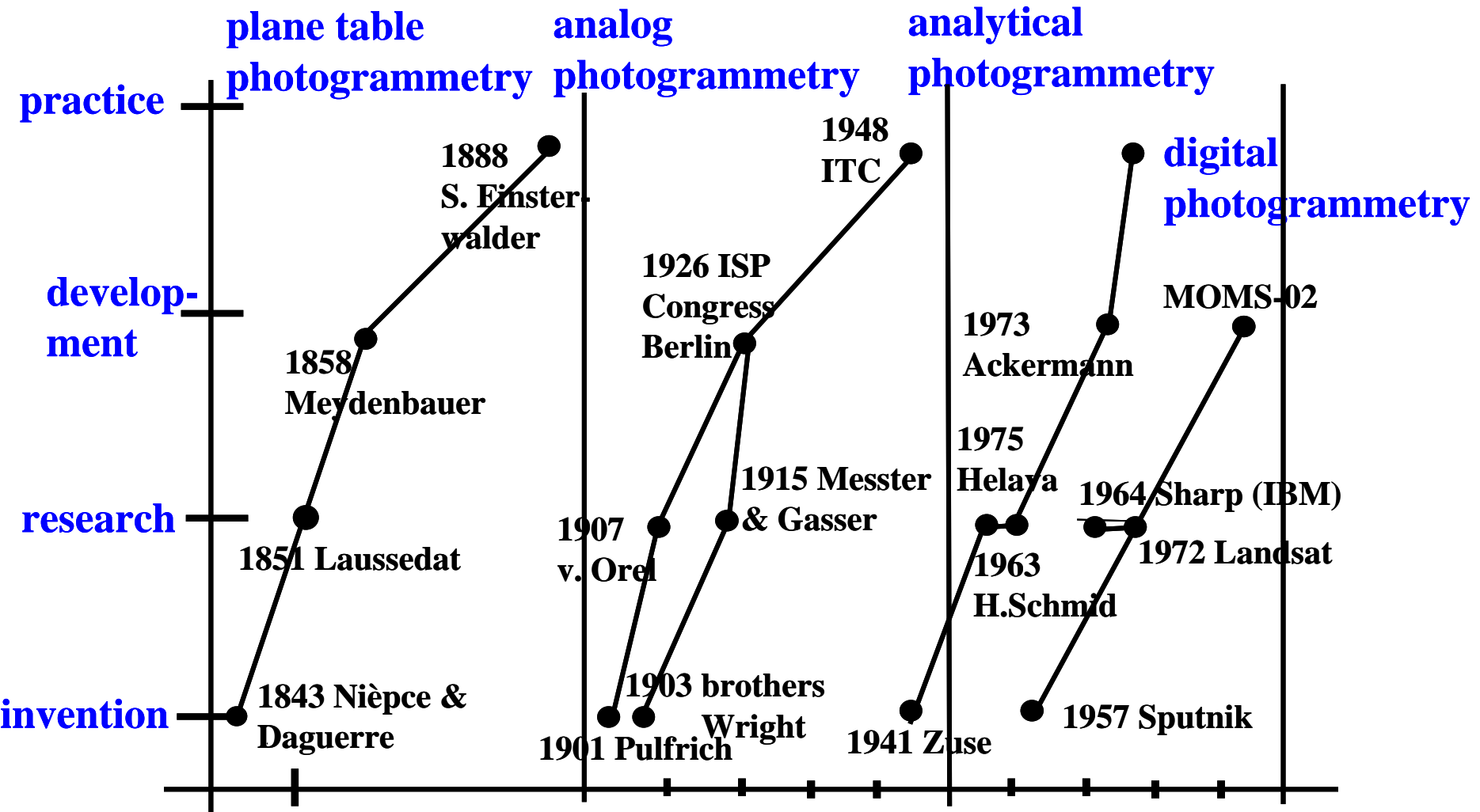
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„White Elephant“ Session**

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# The four development phases of photogrammetry



# **The phases of photogrammetric mapping technology**

- 1. Experimental tool with scientific, military and governmental uses in special cases (Laussedat 1851, terrestrial survey of Paris from rooftops; Meydenbauer 1858 architecture; S. Finsterwalder 1887 glaciers; Deville 1890 Rocky Mountains; Von Orel, Alps)**
- 2. Aerial photogrammetry as competitor to ground surveys (World War I, in 1920's problem in Europe: exaggerated accuracy requirements, in 1930's American Society for Photogrammetry, in 1940's World War II, 1951 ITC: photogrammetry becomes mapping tool for developing world), governmental activities**
- 3. Analytical photogrammetry with computers solves accuracy problem (Duane Brown, Friedrich Ackermann)**
- 4. Outsourcing of mapping to industry, automation of photogrammetric processes (aerial triangulation, image matching, orthophotos versus line mapping)**
- 5. Further automation of feature extraction**

# Founders of the Discipline of Photogrammetry

**Eduard Dolezal,  
Professor,  
Technical  
University of Vienna**

**Founder of the  
Austrian Society  
for Photogrammetry  
1907**

**Founder of the  
International  
Society for  
Photogrammetry  
1910**

**Willem  
Schermerhorn**

**1930's friend of  
Otto von Gruber**

**1938 designated  
ISP Congress  
Director**

**1945 – 1946  
Prime Minister of  
the Netherlands**

**1948 ISP Congress  
In the Hague,  
Netherlands**

**1950 Founder of the  
ITC**

# **Current Photogrammetric Mapping Processes**

- 1) aerial photography**
- 2) digital scanning of aerial photos  
(as digital stereo workstations are now considered state of the art)**
- 3) aerial triangulation to determine position and orientation of the aerial photos**
- 4) digital elevation model generation  
(digital image matching of overlapping images  
is now considered state of the art)**
- 5) digital ortho rectification based on aerial triangulation  
and digital elevation model**
- 6) radiometric matching of adjacent orthophotos from map file to map file  
or better within a seamless geodatabase**
- 7) vector digitization of topographic map features in 2D  
(on screen from the orthophotos) or in 2.5 to 3D (in stereo workstations).**

# Cost Model for Aerial Photogrammetry:

1) aerial photography: mobilization	5000 € plus 10 € per image
2) scanning of film	15 € per image
3) aerial triangulation	25 € per image
4) digital elevation model depending on the need to include manually observed break lines	10 to 100 € per image
5) digital orthophoto production	15 € per image
6) radiometric adaptation of orthophotos	10 € per image
7) vector digitization of features. this is the highest cost factor:	10 to 100 hrs per image times 20 to 40 € per hr

As steps 1) to 6) are mostly automatic operations the processing of DEM's and orthophotos has a raster homogeneous cost factor over the globe.

**Table 2: Cost of orthophotos and line maps from aerial photography; area covered 250 km<sup>2</sup>**

<b>image scale</b>	<b>1:6000</b>	<b>1:45 000</b>
<b>photo dimension</b>	<b>1380 m</b>	<b>10 350 m</b>
<b>air base</b>	<b>552 m</b>	<b>4 140 m</b>
<b>strip width</b>	<b>966 m</b>	<b>7 245 m</b>
<b>net area covered</b>	<b>0,533 km<sup>2</sup></b>	<b>29,99 km<sup>2</sup></b>
<b>number of photos for area</b>	<b>469</b>	<b>8,34</b>
<b>cost of orthophotos with automatic DEM</b>	<b>44 865 €</b>	<b>5 709 €</b>
<b>cost of orthophotos with semi-automatic DEM</b>	<b>87 075 €</b>	<b>6 460 €</b>
<b>additional cost of line maps (European prices)</b>	<b>rural 375 200 € urban 1 876 000 €</b>	<b>6 672 € 33 360 €</b>
<b>additional cost of line maps (Asian prices)</b>	<b>rural 187 600 € urban 938 000 €</b>	<b>3 336 € 16 680 €</b>

# Alternatives for Digital Elevation Models

- |  |                           |            |
|--|---------------------------|------------|
| 1. Digitization of existing contour maps   | 2 €/ km <sup>2</sup>      | +/- 5 m    |
| 2. Shuttle Radar Topogr. Mission SRTM      | free for 90m posting      | +/- 15m    |
| 3. Airborne Radar Interferometry (NextMap) | 4 – 40 €/ km <sup>2</sup> | +/- 1 m    |
| 4. Stereo Satellite Mapping (Spot, Alos)   | 2 – 4 €/ km <sup>2</sup>  | +/- 5 m    |
| 5. Laser Scanning                          | 100 €/ km <sup>2</sup>    | +/- 0.15 m |

## Table 3: Satellite Imagery

Program	Country	GSD	year	use
NOAA satellites	USA	1 km		meteorology, global
Landsat MSS	USA	80 m	1972	vegetation studies
Landsat	USA	30 m	1982	general remote
Spot 1-4	France	10 m	1986	sensing
Spot 5	France	2,5 m	2002	land use studies
Alos	Japan	2,5 m	2006	
Ikonos 2	USA	1 m	1999	stereo option
Quickbird 2	USA	0,6 m	2001	
Orbview 3	USA	1 m	2003	
Topsat	UK	2,5 m	2005	
IRS-P5 Cartosat 1	India	2,9 m	2005	
Formosat 2	Taiwan	2,5 m	2004	
Eros A 1	Israel	2 m	2000	
Eros B	Israel	1,9 m	2006	
Resurs DK 1	Russia	1 m	2006	
World View 1	USA	0,5 m	2007	

# Examples shown for what can be done are from a World Bank Project for the Municipality of Tirana, Albania

Project execution: 6 months in 2005

acquired were:

- 1 Quickbird satellite image (273 km<sup>2</sup>) –orthoready product
- 1 server with ArcSDE linked to Oracle
- 2 ArcExplorer
- 10 ArcView

field survey:

ITRF connection for GPS/DGPS contracted for 4 primary points, densification via RTK to 60 control points for geocoding of satellite image, detail survey with GPS linked field computer

cost: 200 000\$ for 60 km<sup>2</sup>

## **Result of Project:**

**The Municipality of Tirana now has data to monitor and to plan urban development**

- **quickly (6 months)**
- **inexpensively (2000 to 3000\$ per square km)**
- **updatable every year (by newly ordered satellite image at cost of 5000\$ and by local maintenance contract)**

# Threats to Photogrammetric Mapping

- 1. The USGS Topo Mapping at 1:24 000 with 1m GSD orthophotos can be updates every 5 to 10 years**
- 2. The German Topo ATKIS System at 1:10 000 with 0.4m GSD orthophotos can be updated every 5 years**
- 3. The British Ordnance Survey commits itself to 6 month updates with DGPS and Field PC ground surveys using CORS for the 1:1250 or 1:2500 topo map and Google Earth images**
- 4. The German ALKIS System is a „real time“ transaction based cadastral data system for parcels and buildings using CORS DGPS surveys**

# **Present Problems:**

- 1. National Photogrammetric Industry is being bought up by global consortia (Bloom, Fugro)**
- 2. National Photogrammetric Industry outsources to partners in low cost labour countries**
- 3. The old European hardware/software manufacturing industry is no more; development is controlled in the USA (Intergraph Erdas, Trimble, Microsoft; it was sold, because „a 100 M\$ market is too small to keep“**
- 4. Haphazard patents have been issued on small technical modifications; protection by patent rights is too lengthy and too costly (orthophotos for cadastral applications, oblique imagery, airborne stereo scanners)**

# What to do next ?

- 1. ISPRS has contributed to phenomenal achievements**
  - landing on the moon
  - exploration of planets
  - monitoring of the earth
- 2. Global monitoring is an ISPRS mandate**
- 3. We must find new structures, how to do the task more efficiently with the new tools**
  - satellite platforms
  - new sensors (radar, laser)
  - GNSS uses
- 4. Use of International Earth Observation Programs**

# **1. Earth Observation Programs**

- **GEOSS (int.)**
- **GMES (EU)**

# **2. Contributions to global Monitoring**

- **Earth Observation Systems**
- **Knowledge-based Image Analysis**

# **The Phases of Remote Sensing Technology**

- 1. Early Applications**  
**(1870's photographic interpretation in forestry, 1950's false colour infrared film for camouflage detection, infrared scanners, SLAR research uses)**
- 2. Lunar and Planetary Exploration (Moon, Mars, Venus)**  
**(1960's USA & USSR)**
- 3. Landsat (Earth Resources Satellite) 1972, 1982**  
**(global reseearch community development)**
- 4. Satellite systems with improved resolution and sensing capabilities (Ikonos 1999, ERS1, Radarsat) – space agencies**
- 5. Global operational monitoring programs - governments**
- 6. Regional efforts (CORINE, Africover) – value added enterprises**

# **Conclusions:**

- 1. We are in a globalized world**
- 2. So that our geoinformatics profession does not become the playball of new capital structures we need our professionalism**
- 3. Quality can only be assured by our professionalism, which is based on solid education and lifelong learning**

## **Conclusion:**

- 1. Remote sensing and photogrammetric mapping are part of geoinformatics**
- 2. in the geoinformatics sector considerable efforts have been made, which are fully recognized, but which due to the fragmentation of economic and technical cooperation activities have not been fully implemented in the development countries, where they are needed most**
- 3. geoinformatics should be a prime sector in economic and technical cooperation**
- 4. two thirds of the international donors in economic and technical cooperation come from 5 countries, the USA, Britain, Japan, France and Germany but only a small portion is in geoinformatics, why?**

## International public contributions to the Developing Countries (2002) & (2006)

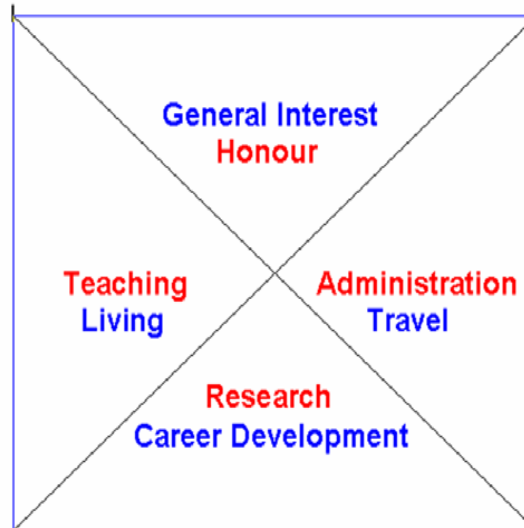
<b>USA</b>	<b>15.603 B\$</b>	<b>22,739 B\$</b>
<b>Japan</b>	<b>9.362 B\$</b>	<b>11,608 B\$</b>
<b>France</b>	<b>6.950 B\$</b>	<b>10.448 B\$</b>
<b>Germany</b>	<b>6.104 B\$</b>	<b>10.351 B\$</b>
<b>Great Britain</b>	<b>5.418 B\$</b>	<b>12.607 B\$</b>
<b>Sum (5 countries)</b>	<b>43.437 B\$</b>	<b>67.753 B\$</b>
<b>Total</b>	<b>64.403 B\$</b>	<b>103.9 B\$</b>

# **the „sociological cast system“**

<b>1. highest cast</b>	<b>keepers of the myth</b>	<b>priests, politicians</b>
<b>2. second cast</b>	<b>those giving health to men</b>	<b>medical doctors</b>
<b>3. third cast</b>	<b>those giving rights to men</b>	<b>lawyers, the military</b>
<b>4. lowest cast</b>	<b>helpers of the throw</b>	<b>scientists, engineers</b>

age  „White Elephant Club“ of ISPRS  
„Club of Istanbul“  
„Elephants against Crocodiles“

Joint Board,  
(IUSM \*1984  
+1997)



NGO with UN

Commissions I to VIII

the older you get, the more philosophical you should be

# The Greek Philosophers

**Socrates**

**469 - 399 B.C.**

**search for truth  
in modesty**

**Plato**

**427 – 348 B.C.**

**the world cannot  
be clearly seen,  
but beauty, art  
and science are  
the ideals, highest  
value is equality**

**Aristoteles**

**384 – 322 B.C.**

**ideas are the  
basis of being  
within a natural  
order, highest  
value is freedom**

**Epicure**

**341 – 270 B.C.**

**human aim is  
to enjoy life in  
peace without  
fear**

# Religious Philosophy

**Lord Buddha  
and his teaching**

**Confutius  
and Laotse**

**Augustinus and  
Christian philosophy**

**Moslem philosophy  
Avicenna, Averroes**

**5th to 4th cent. B.C.**

**551- 479 B.C.**

**354 – 430 A.D.**

**1126 – 1198 A.D.**

**the world is not  
perfect, its  
suffering can be  
overcome by  
victory over  
vices**

**keep the  
wisdom of  
tradition but  
check whether  
it is falsified by  
egotism**

**the bad in the  
world and its  
temptations  
can be overcome  
by god's grace**

**Aristotelian  
philosophy is  
not in disagreement  
with Islam**

# Renaissance

**1469 - 1527**

**1561 - 1626**

**1588 – 1679**

**1632 - 1704**

**Niccolo Machiavelli**

**Francis Bacon**

**Thomas Hobbes**

**John Locke**

**political philosophy  
Is the aim to obtain  
power by all means**

**knowledge is  
power,  
knowledge  
permits to  
control nature**

**man as a wolf is  
controlled by  
self-interest, a  
sovereign keeps  
him from mutual  
destruction**

**in science and  
in society a  
knowledge  
compromise is  
needed, human  
rights are  
natural rights**

# Enlightenment

**1646 - 1716**

**Gottfried Wilhelm  
Leibniz**

**the world consists of  
souls, god brings  
them together in  
harmony**

**1694 - 1778**

**Voltaire**

**deism (belief  
in an impersonal  
god) fights the  
church**

**1712 - 1778**

**Jean-Jacques  
Rousseau**

**man's nature is  
good, the state  
must revert to a  
natural community  
in which egotism  
brought by civilization  
is suppressed**

**1724 - 1804**

**Immanuel Kant**

**ethical and  
esthetic rules  
developed in  
freedom**

# Post Revolution Period and Industrialization

**1770 - 1831**

**Georg Friedrich  
Wilhelm Hegel**

**after French  
revolution  
historical positivism**

**1788 - 1860**

**Arthur  
Schopenhauer**

**the world and life  
are a chaos**

**1818 - 1883**

**Karl  
Marx**

**strife for a  
free society  
ruled by the  
working class**

**1844 - 1900**

**Friedrich  
Nietzsche**

**nihilism  
„god is dead“,  
yes to life  
against conventions**

## 20th Century

**1872 - 1970**

**Bertrand Russell**

**liberal and pacifist  
political and moral  
beliefs**

**1902 - 1994**

**Karl Popper**

**balance between  
radical philosophical  
criticism and naive  
belief in science**

**1905 - 1980**

**Jean-Paul Sartre**

**existence is  
drafted by man  
in freedom, but  
imbedded as a  
social being**

**1929**

**Jürgen Habermas**

**system theory and  
reason as moral  
basis for  
political criticism**

# Science Revolution

**Natural Sciences**

**1879 - 1955**

**Albert Einstein**

**Social Sciences**

**1856 - 1939**

**Sigmund Freud**

# **Scientific Basis of Remote Sensing**

**1858 - 1947**  
**Max Planck**

# **Conclusion: Open Questions**

- 1. what do we know? what are our limitations (Kant)  
(Socrates: „I know, that I know nothing“)**
- 2. what are our values? (religion, philosophic ideas)**
- 3. how do we interrelate with society? (Epicure versus Marx)**
- 4. how do we achieve**
  - sustainable development (UNCED Rio 1992)?**
  - sustainable happiness (where is paradise)?**
  - a sustainable world (environment, peace)?**

## **Conclusion: possible answers**

- 1. We are too busy and do nothing (present Western society),  
when problems arise there is despair**
- 2. We take our answers from our religious beliefs  
(in case of dogmas there may be lack of tolerance and conflict)**
- 3. We take advice from philosophers  
(they analyzed it all, but they are unable to tell us what to do)**

**In consequence, everyone needs to build up his own philosophy,  
otherwise you cannot be a „White Elephant“.**