



An Overview of Space Technology Analysis from Patent Documents

Lerson Tanasugarn
Chulalongkorn University

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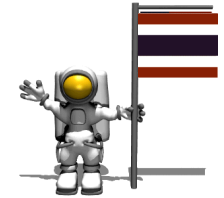


History

History of Patent Document Analysis

- Developed in industrialized countries
 - USA ?
 - Japan
- Developed for use mainly in the private sector (firm level)
 - undisclosed activities related to technology management in general
 - and to intellectual property management in particular
- Technology Digest by USPTO in the 1980s
- Not widely known before 1997 (B.E. 2540)

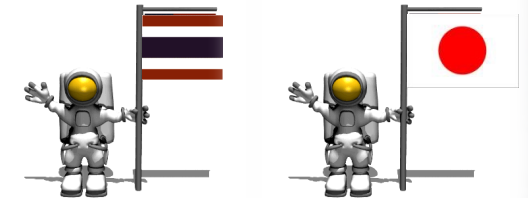
Introducing Pat Analysis into Thailand



Proposed to analyze patents related to space (but did not know how)

- 1996 MOCT's Space Trip to France

The Japanese Examples



- Japanese speakers from different companies all used the same type of patent analysis
- Saw results but no methodology
- Japanese experts did not want to talk about patent analysis

- 1997 AOTS/JIII Intellectual Property Program

Testing the Methodologies



- Supported by NRCT, ShinSat, & ThaiSat
- Conducted at CU Institute of IP
- Analyses done by hand and EXCEL
- Importance of Expert Opinion

More Recently



Toryod.com
partially supported by
Thailand Research
Fund (TRF) to
disseminate patent
search and analysis
techniques

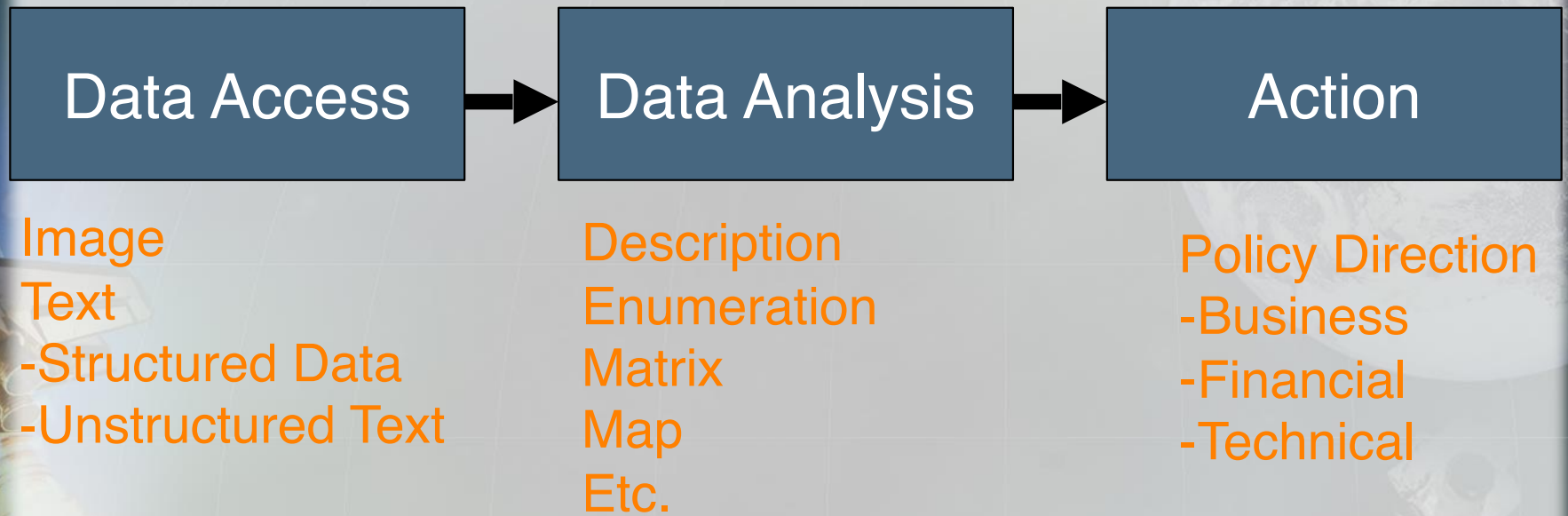


The Siam Cement Group

Siam Cement Group
of Companies -
started to analyze
patent documents for
technologies and
technological trends

Basic Logic of Technological Analysis

Technological Analysis

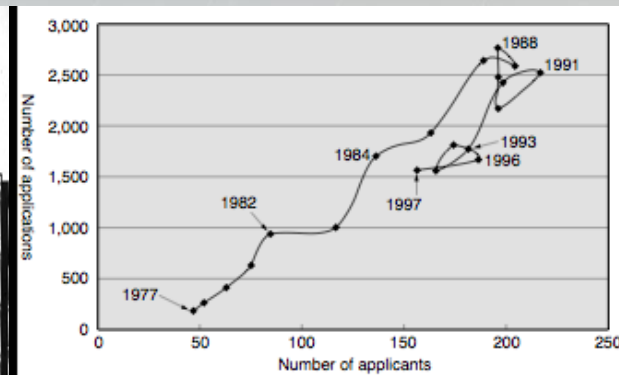
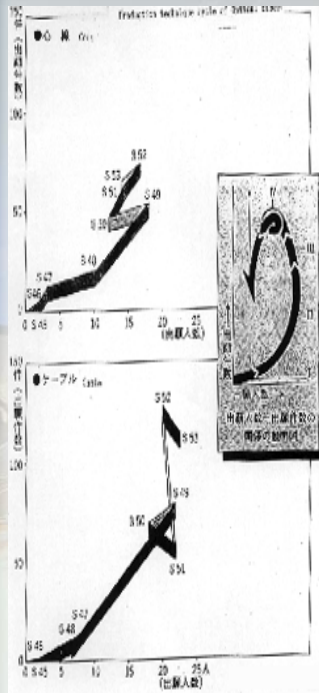


- Data analysis
- Find meaningful results from possibly a lot of data
- Can be viewed as an intermediate step in data preparation for use in decision-making, policy-formulation, etc.
- Derive its usefulness from subsequent actions

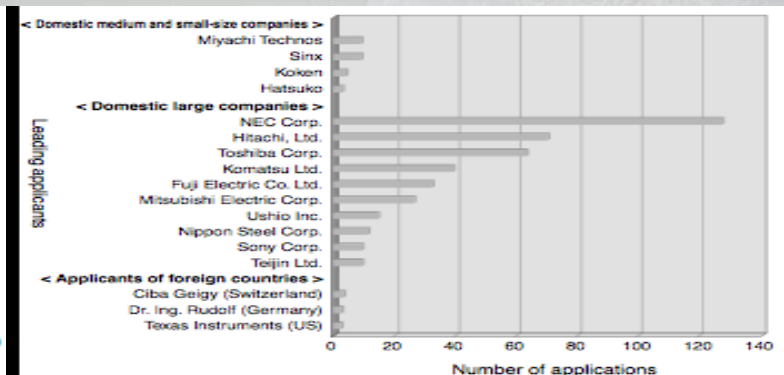
Competitive Technological Intelligence

- What are they doing?
- How successful are they and why?
- Who are the key players?
- What is their R&D financial and HR strength?
- What technology, intellectual property or patents do they hold? Who else are holding IP in the industry?
- How are they positioned in the industry?
- What technological trends can we identify?
- Is there a technological niche we can fit in?
- Where can we find a strategic partner?
- Who are their technical brains and how many teams are at work?
- Etc.

Basic Quantitative Analyses

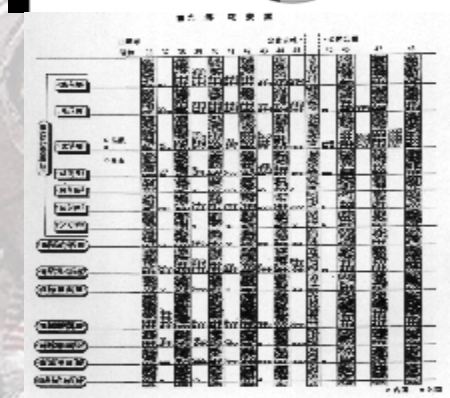
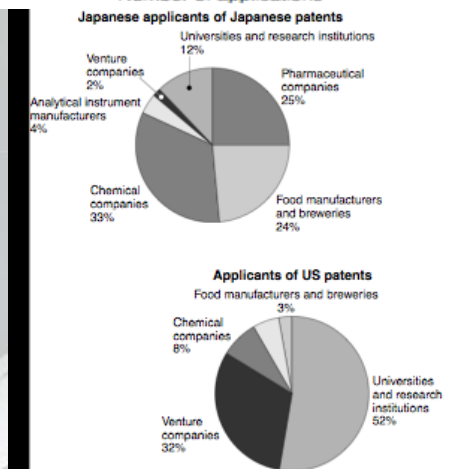


Source: JPO/JIII



Source: JPO/JIII

- Rate Map
- Number Map
- Trend Map
- Relation Map
- Radar Map
- Portion Map
- Etc.



Basic Qualitative Analyses

☆: Other companies ★: Own company

	Reliability	Economic feasibility	Sense of quality	Safety	Total
Dimming	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆	☆☆☆☆	20
	★★★	★★★★★	★	★★	12
Heat reflection	☆☆☆☆☆	☆☆☆☆☆	☆☆☆☆	☆☆☆☆	21
	★★★★★	☆☆☆☆	☆☆☆☆	☆☆	10
Shading	☆☆☆☆☆	☆☆	☆☆☆☆	☆☆☆☆	16
	☆☆☆☆	★	★	★★	4
Total	16	15	14	12	57
	10	26	7	22	4
	26	7	22	4	18
	5	17	26	83	

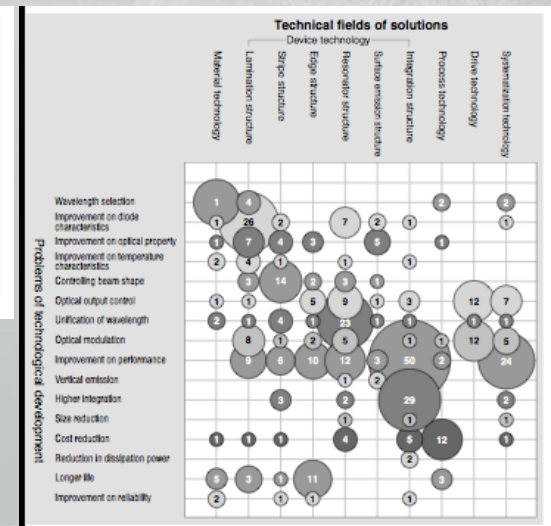
Total column : No. of rights held by other companies (upper figure) and those held by own company (lower figure)

Source: JPO/JIIC

Objective/Effect	Promotion of fermentation '80 '85 '90	Improvement of fertilizer quality '80 '85 '90	Standardization of fertilizer quality '80 '85 '90	Cost reduction '80 '85 '90
Method/means				
Pretreatment	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Additives	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Microorganisms	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Aeration	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●
Control	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●	● ● ● ● ●

● : Published or registered patents △ : Unexamined patents (pending)

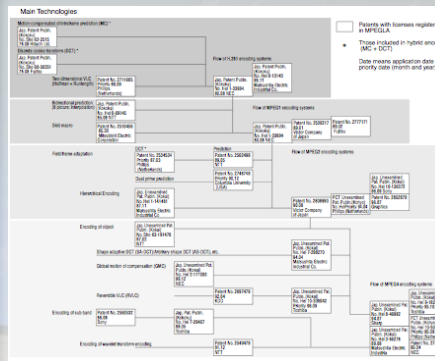
Source: JPO/JIIC



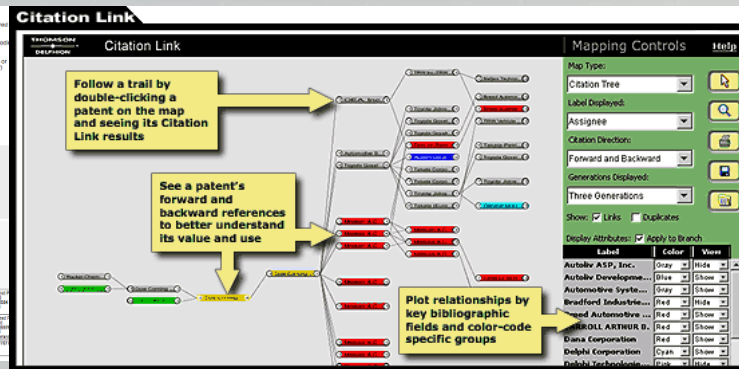
Source: JPO/JIIC

- List Map
- Matrix Map
- TEMPST Map
(Treatment, Effect, Material, Process, Product, Structure)
- Development Map
- Problems vs Solutions Map

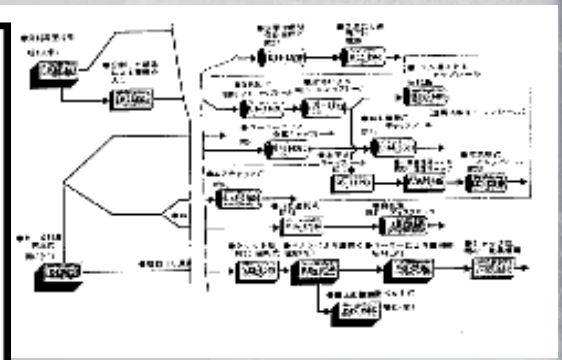
Citation Analysis



Source: JPO/JIII



Source: Citation Link



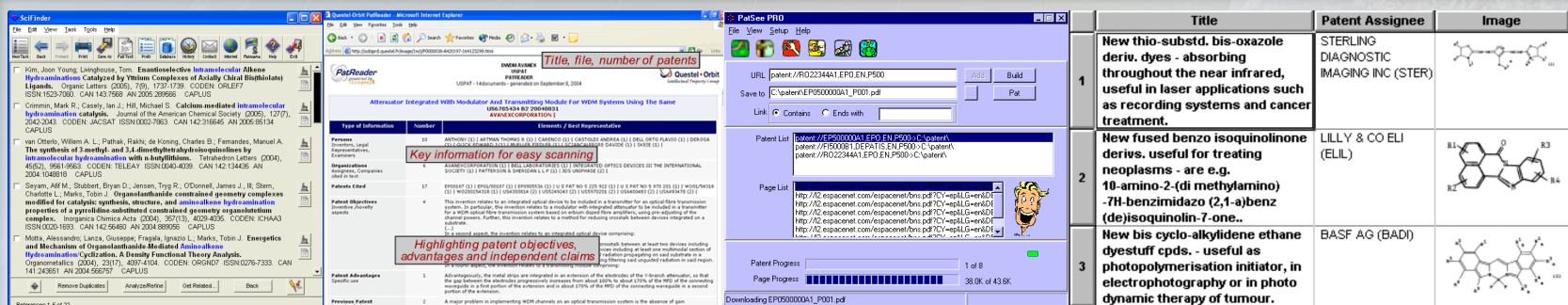
Source: JIII

- Forward & backward citation
- Technological progress
- Potential uses and potential licensees

A composite image featuring a space shuttle launching on the left, an astronaut in a white suit floating in the lower right, and a large view of Earth from space in the background. A faint grid pattern is overlaid on the entire image.

Analytical Tools

Patent Info Access, Display & Download

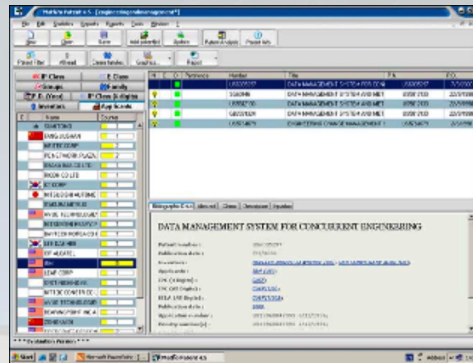


The image displays four software interfaces used for patent information access, display, and download:

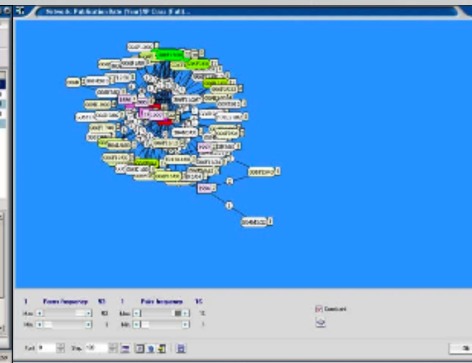
- Sci Finder:** A search engine interface showing a list of patent results with columns for Title, Number, and Date. It includes a search bar and various filters.
- PatReader:** A detailed view of a patent document, showing the title, abstract, and full text. It includes a table of contents and a list of references.
- PatSee Pro:** A software interface for downloading patent documents. It shows a list of patents and a progress bar for the download status.
- BizInt Smart Chart:** A software interface for displaying patent information in a structured table format. It includes columns for Title, Patent Assignee, and Image.

- Search engine and interface
- Intelligent information display
- Download patent information only
- Format data into structured tables

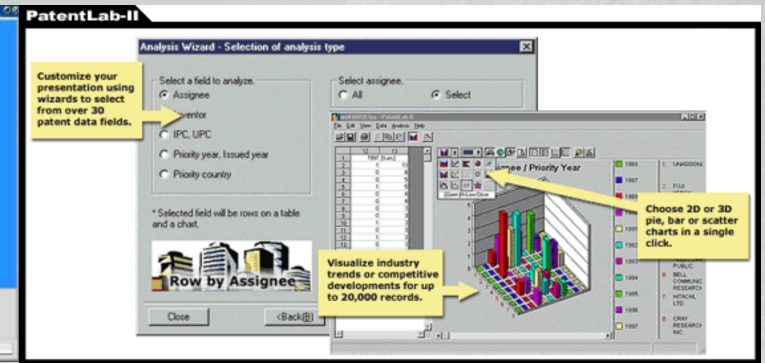
Quantitative/Qualitative S/W



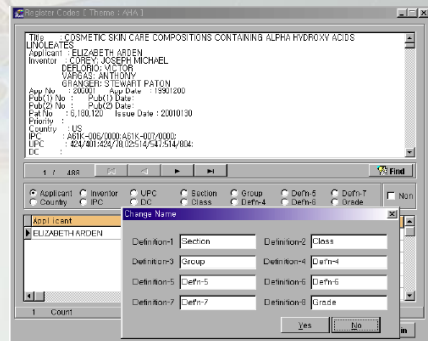
Matheo Patent



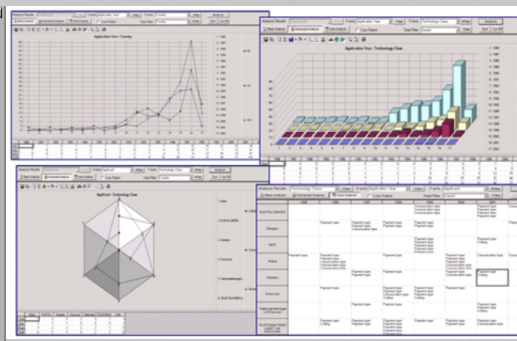
Matheo Patent



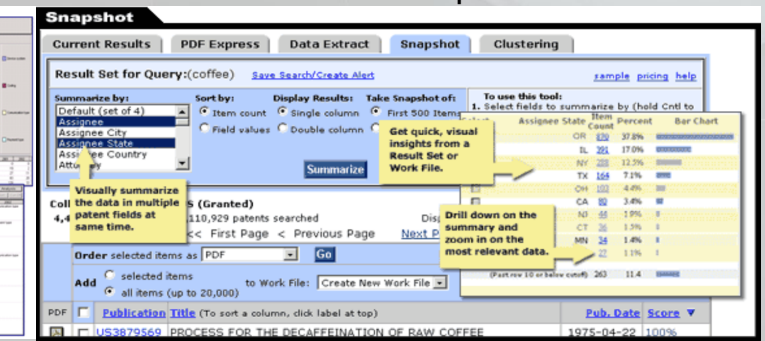
Delphion's PatentLab II



INAS



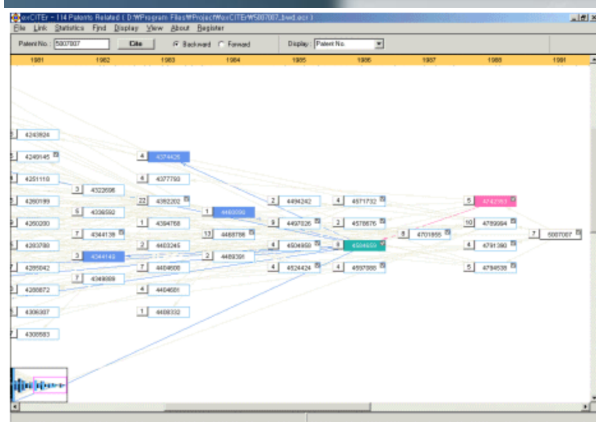
WIPS



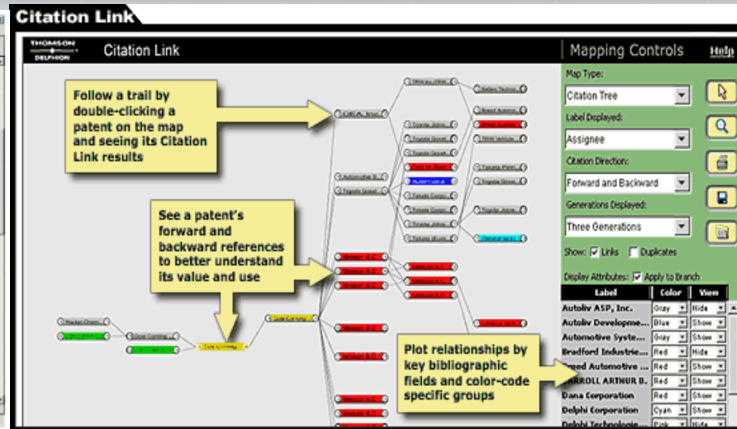
Delphion's Snapshot

- Statistical evaluation of data
- Simple relationship of data
- Clustering of data
- Presentation (display)

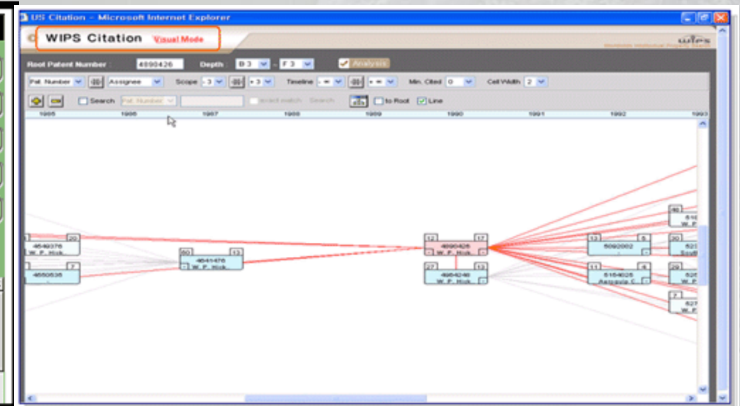
Citation Analysis S/W



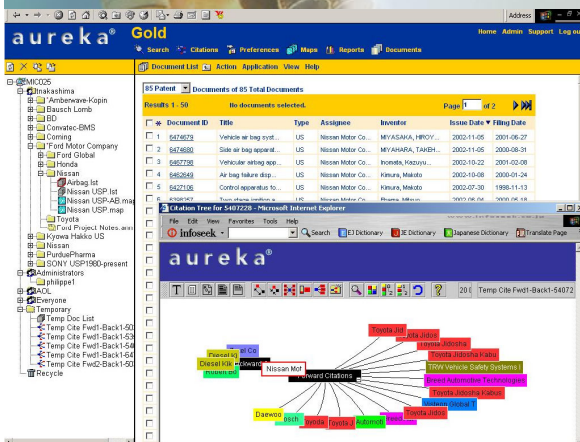
exCITER



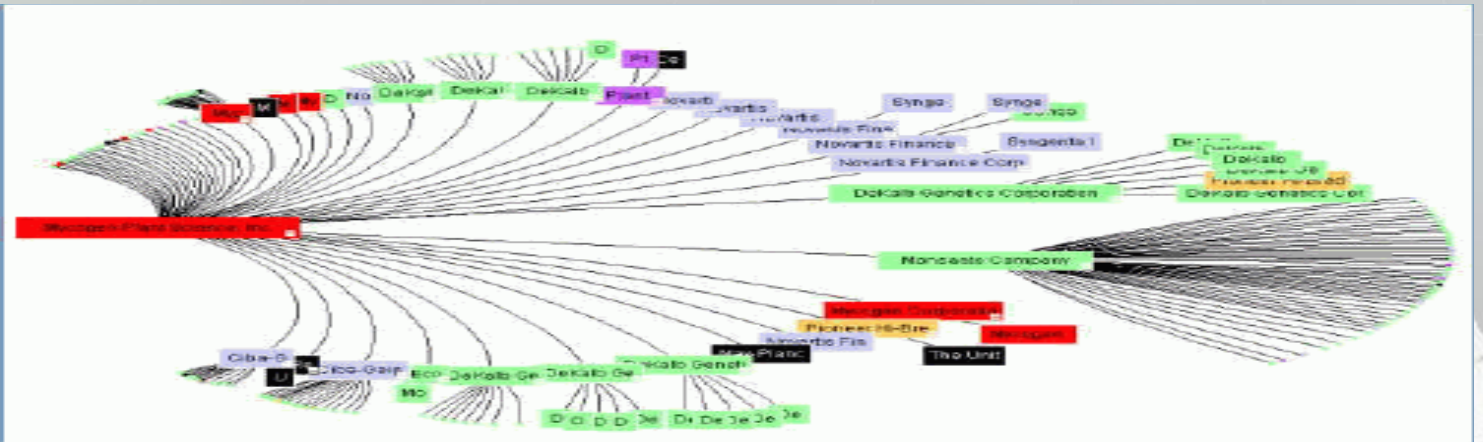
Delphion Citation Link



WIPS Citation



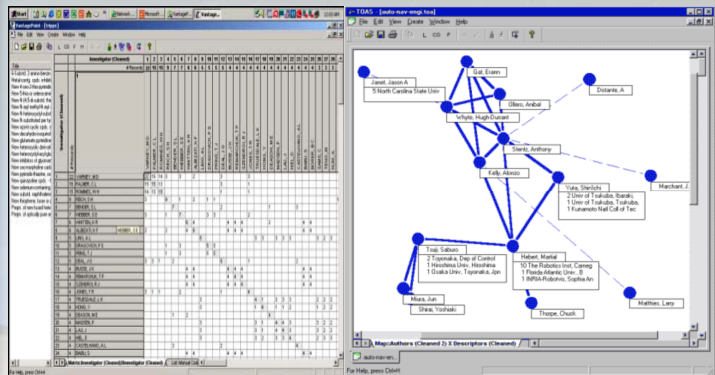
aureka



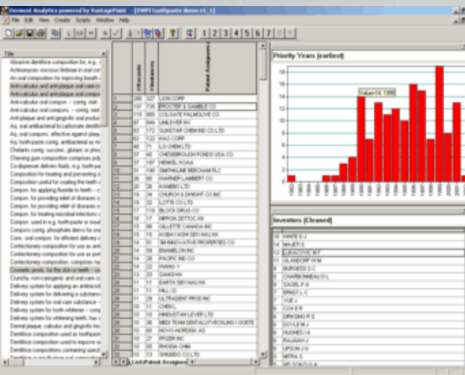
Aureka (Hyperbolic Citation Tree licensed from InXight)

- Forward & reverse references
- Presentation (Display)
- Free web-based citation, e.g. Metrics Group's Citation Bridge

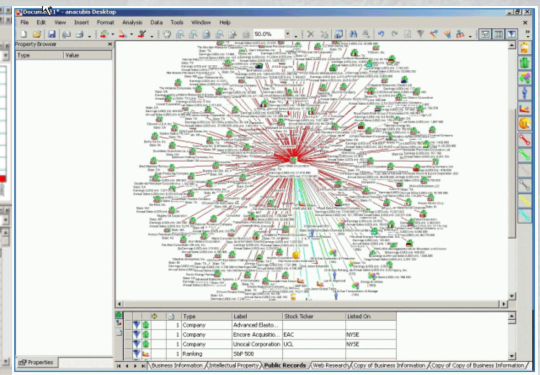
General Data Mining S/W



Vantage Point

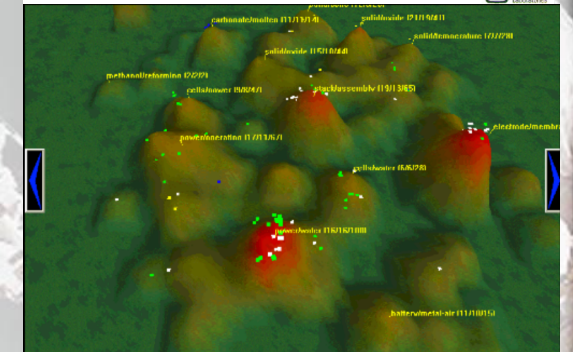
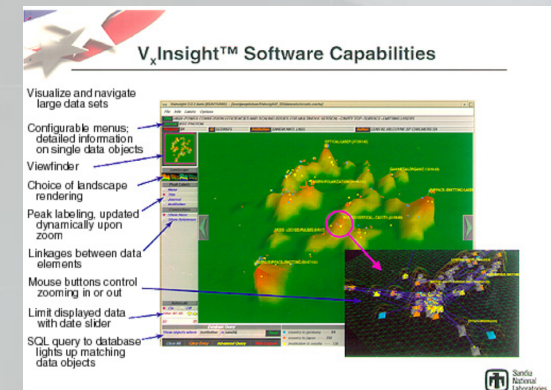


Derwent Analytics



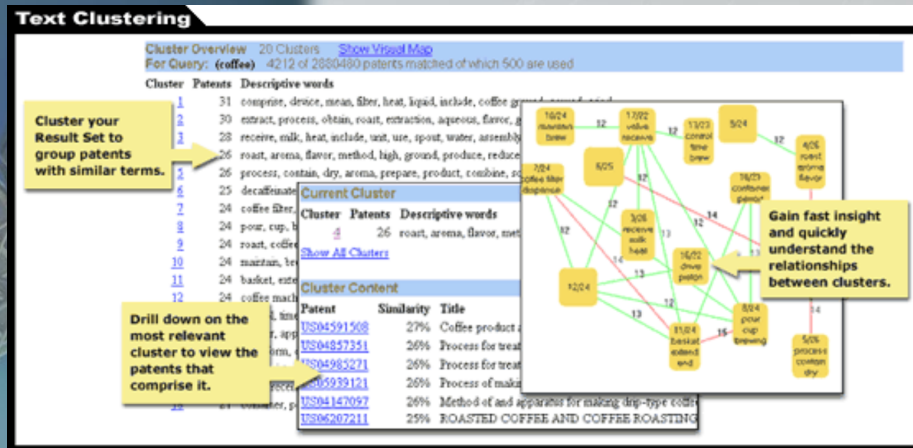
Anacubis

- Matrix & Graphic styles
- Strategic partnership (database & data mining s/w)
- Display style
 - Icon (Anacubis)
 - Topography (VxInsight)

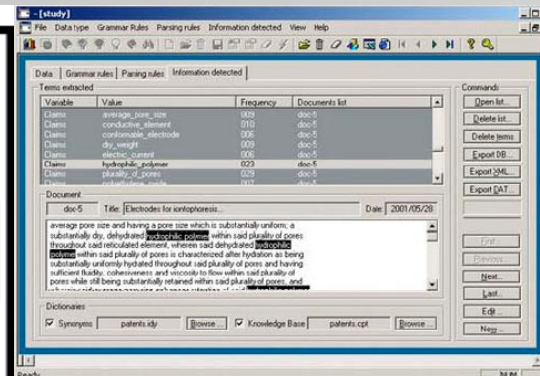


VxInsight

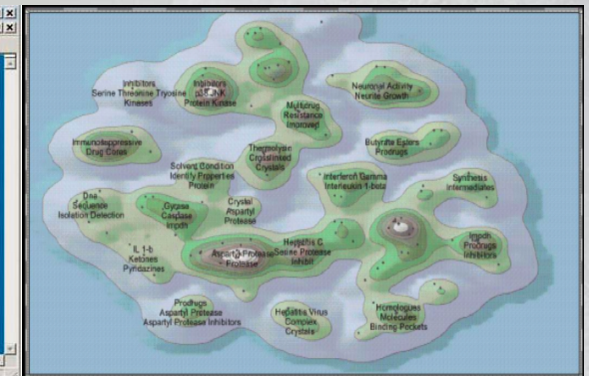
Text Mining S/W (1)



Delphion Text Clustering



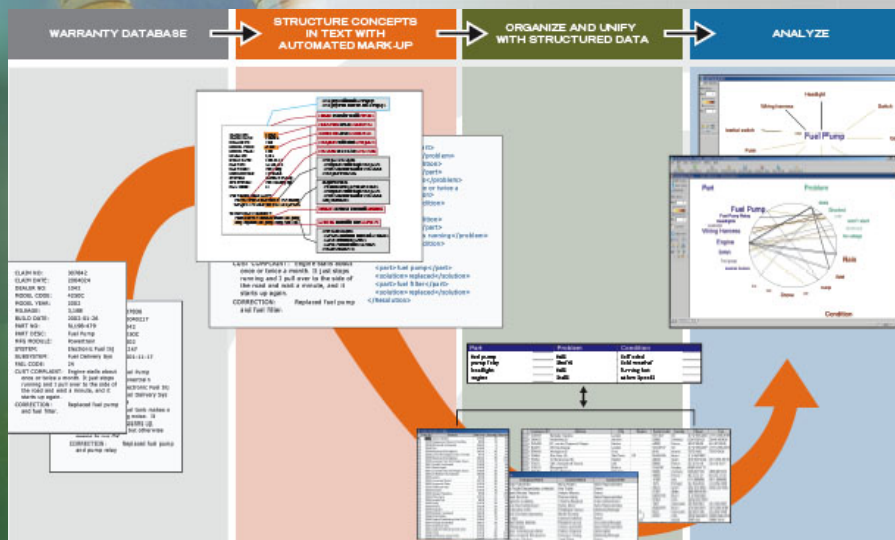
IBM/Synthema



Aureka ThemeScape

Extraction -> Tagging -> Consolidate with other data -> Display

- Linguistics models
- Concept mapping
- Thematic mapping



ClearForest

Text Mining S/W (2)

Input: Format: Plain text Codaset: CP1252 Load...

L'Assemblée générale

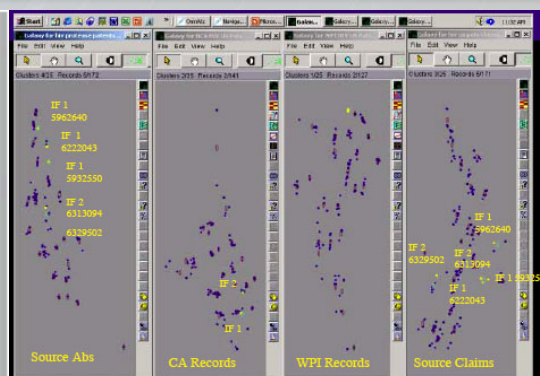
Proclame la Déclaration universelle des droits de l'homme comme idéal commun à atteindre par tous les peuples et toutes les nations

Result: Format: HTML IE Style: Filtered

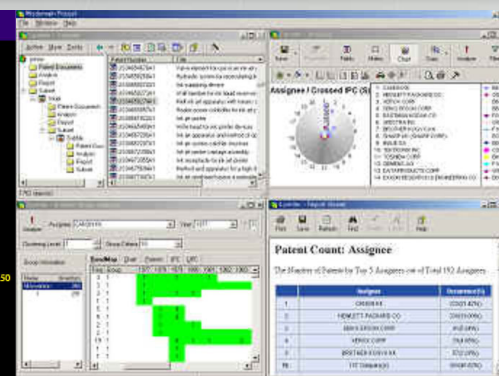
pos-disambiguation

- L' [0-1]
 - le **+DET_SG**
- Assemblée [2-10]
 - assemblée **+NOUN_SG**
- générale [12-19]
 - général **+ADJ_SG**
- Proclame [25-32]
 - proclamer **+VERB_P3SG**
- la [34-35]
 - le **+DET_SG**
- Déclaration [37-47]
 - déclaration **+NOUN_SG**
- universelle [49-59]
 - universel **+ADJ_SG**
- des [61-63]
 - de=le **+PREP_DE**
- droits [65-70]
 - droit **+NOUN_PL**
- de [72-73]
 - de **+PREP_DE**
- l' [75-76]
 - le **+DET_SG**
- homme [77-81]
 - homme **+NOUN_SG**
- comme [83-87]
 - comme **+COMME**
- l' [89-90]
 - le **+DET_SG**
- idéal [91-95]
 - idéal **+NOUN_SG**
- commun [97-107]

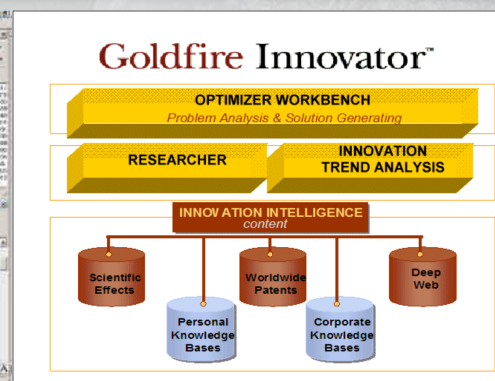
TEMIS Xelda Multilingual
Linguistic Engine



OmniViz



WisDomain Focust



Invention Machine
Goldfire Innovator

- Multilingual engine available
- Integration with nonpatent data
 - chemistry & biology (OmniViz)
 - Specialized technology DB (Invention Machine Goldfire Innovator)

Intellectual Property Management S/W

- Aurigin Systems, Inc.
Aureka Intellectual Property Asset Management (IPAM)
 - Run on corporate server
 - About **1 million baht/year** to run
 - Complete suite for management & analysis
- Anaqua, Inc. (web-based)
 - IP asset management
 - Case management
 - Workflow management
 - Case docket & diary management
 - Cost tracking
 - Document generation management



A composite image featuring a space shuttle launch on the left, an astronaut in a white suit floating in the lower right, and a large view of Earth from space in the background. A faint grid pattern is overlaid on the entire image.

Technical Fields

Technical Fields in Attitude Control

- **Major Fields**

- B64G1/00, 22, 24, 26, 28, 34, 36, 44, 62, COSMONAUTICS; VEHICLES OR EQUIPMENT
- G05D1/08 SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES
- B64D EQUIPMENT FOR FITTING IN OR TO AIRCRAFT; FLYING SUITS; PARACHUTES; ARRANGEMENTS OR MOUNTING OF POWER PLANTS OR PROPULSION TRANSMISSIONS

- **Minor Fields**

- **Sensor**

- G01B11/26 MEASURING LENGTH, THICKNESS, OR SIMILAR LINEAR DIMENSIONS; MEASURING ANGLES; MEASURING AREAS; MEASURING IRREGULARITIES OF SURFACES OR CONTOURS
 - G01C2/26 MEASURING DISTANCES, LEVELS, OR BEARINGS; SURVEYING; NAVIGATION; GYROSCOPIC INSTRUMENTS; PHOTOGRAMMETRY
 - G01J1/02, 20 MEASUREMENT OF INTENSITY, VELOCITY, SPECTRAL CONTENT, POLARISATION, PHASE OR PULSE CHARACTERISTICS OF INFRA-RED, VISIBLE OR ULTRA-VIOLET LIGHT; COLORIMETRY; RADIATION PYROMETRY
 - G01S5/16 RADIO DIRECTION-FINDING; RADIO NAVIGATION; DETERMINING DISTANCE OR VELOCITY BY USE OF RADIO WAVES; LOCATING OR PRESENCE-DETECTING BY USE OF THE REFLECTION OR RERADIATION OF RADIO WAVES; ANALOGOUS ARRANGEMENTS USING OTHER WAVES
 - F16F15/02 SPRINGS; SHOCK-ABSORBERS; MEANS FOR DAMPING VIBRATION

- **Actuator**

- B25J5/00 MANIPULATORS; CHAMBERS PROVIDED WITH MANIPULATION DEVICES

- **Control**

- G06F15/50 ELECTRIC DIGITAL DATA PROCESSING
 - G05D1/00 SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES

International Patent Classification

Inventors **Applicants**

IPC Class **ECE Class**

Groups **Family** **PR. (Year)**

P.D. (Year) **IPC Class (4 digits)**

C	Name	Family
B64G		48
G05D		14
G01C		7
G06F		4
G01S		2
G01J		2
F02K		2
G01P		1
G01D		1
G01B		1
F16F		1
F16C		1
F03H		1
B64K		1
B64D		1

COSMONAUTICS; VEHICLES OR EQUIPMENT THEREFOR (apparatus for, or methods of, winning materials from extraterrestrial sources E21C 51/00)

Inventors **Applicants**

IPC Class **ECE Class**

Search

S	C	D	...	Number
⚡				JP2004299541
⚡				US5140525
⚡			+	EP0347585
⚡			+	US5107434
⚡			+	EP1099093
⚡			+	EP0573284
			+	WO0156882
⚡				US2005133671
⚡			+	US2003106966
⚡				US6616104
⚡				US4807835
⚡			+	JP1301498
⚡			+	US5092543
⚡			+	US5248118
⚡			+	CA2094215
⚡				EP0919463
⚡			+	EP0919464
⚡				US5130931
			+	EP1103464
			+	AU2003256519

ATTITUDE DETERMINATION

Bibliographic Data Abstract Inpadoc

Inventors **Applicants**

IPC Class **ECE Class**

C	Name	Family
G05D1/08		12
B64G1/28		12
B64G1/24		12
B64G1/26		9
B64G1/38		7
B64G1/36		6
B64G1/22		4
B64G1/34		3
G06F15/50		2
G05D1/00		2
G01J1/20		2
G01C21/02		2
B64G1/44		2
B64G1/00		2
G06F7/00		1
G06F17/00		1
G01S5/16		1
G01S3/786		1

SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES (for continuous casting of metals B22D 11/16; valves per se F16K; sensing non-electric variables, see the relevant subclasses of G01; for regulating electric or magnetic variables G05F)

Bibliographic Data Abstract Inpadoc

S	C	D	...	Number
⚡				EP0347585
⚡				FR2679345
⚡				JP1301498
⚡				EP0338687
⚡				CN1074187
⚡				EP0949143
⚡				AU2003233380
⚡				EP0507460
⚡				JP2128995
⚡				JP11227698
⚡				EP1422138
⚡				US5225885

Bibliographic Data Abstract Inpadoc

ATTITUDE DETERMINATION

User Comment :
Patent number :
Publication date :
Inventors :
Applicants :
IPC (4 Digits) :

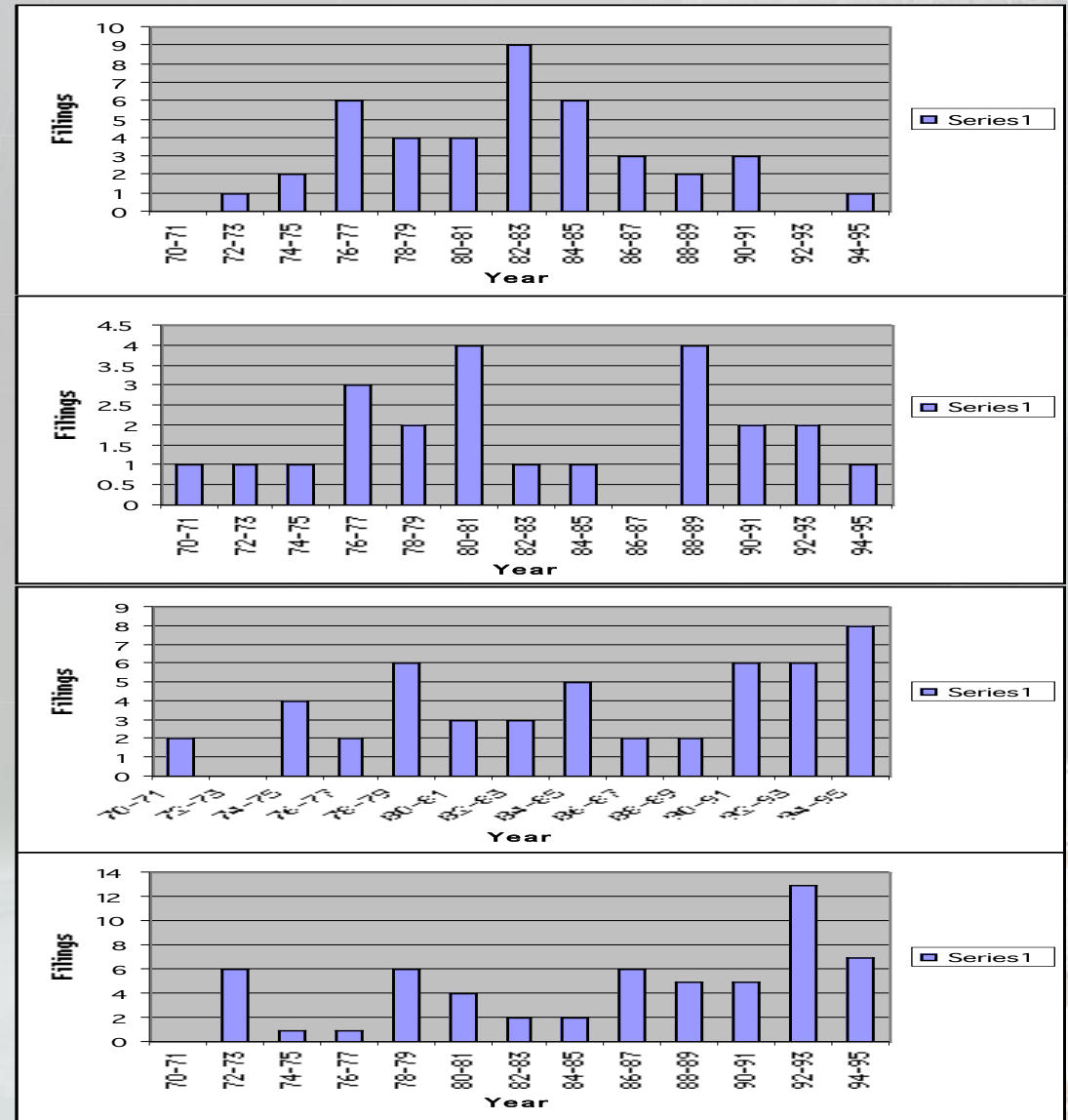
IPC4 vs IPC7

The background of the slide is a composite image. On the left, a space shuttle is shown launching, with its boosters and external tank visible, and a large plume of white smoke and fire at the bottom. On the right, an astronaut in a white spacesuit is floating in space, with various equipment and a small satellite visible. The Earth is visible in the upper right corner, and the Moon is visible in the lower left corner. The entire scene is overlaid with a faint grid pattern.

Temporal Analysis of Inventions

Electrical System (Manual)

- Chemistry
- Packaging
- Charging
- Regulating



US Patent (1970-1995)

Temporal Analysis

COSMONAUTICS

Inventors		Applicants	
Groups	Family	PR. (Year)	
IPC Class		E Class	
P.D. (Year)		IPC Class (4 digits)	
C	Name	Family ▾	
	1999	11	
	1992	8	
	2003	7	
	2001	7	
	1993	7	
	1989	6	
	2004	4	
	2002	4	
	2005	3	
	1990	3	
	1965	2	
	1981	1	
	1977	1	
	1976	1	
	1973	1	
	1972	1	
	1971	1	
	1970	1	

	2005	2004	2003	2002	2001	1999	1993	1992	1990	1989	1981	1976	1972	1971	1973	1970
G06F	1		1					1		1						
B64G	1	3	6	3	6	10	6	7	2	6	1	1				
G01C	1	1	1	1	1		2	1					1			
G05D		1	2			3	4	2	2	3						
B64D		1														
B25J				1	1											
F16C				1	1											
G01P							1									
G01S							1			1						
G01B							1	1								
B64C								1								
B64B									1							
G01D														1		
G01J															1	1
F16F		1														
F03H			1													
F02K			1			1										
B64K				1	1											

SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES

MEASUREMENT OF INTENSITY, VELOCITY, SPECTRAL CONTENT, POLARISATION, PHASE OR PULSE CHARACTERISTICS OF INFRA-RED, VISIBLE OR ULTRA-VIOLET LIGHT; COLORIMETRY; RADIATION PYROMETRY

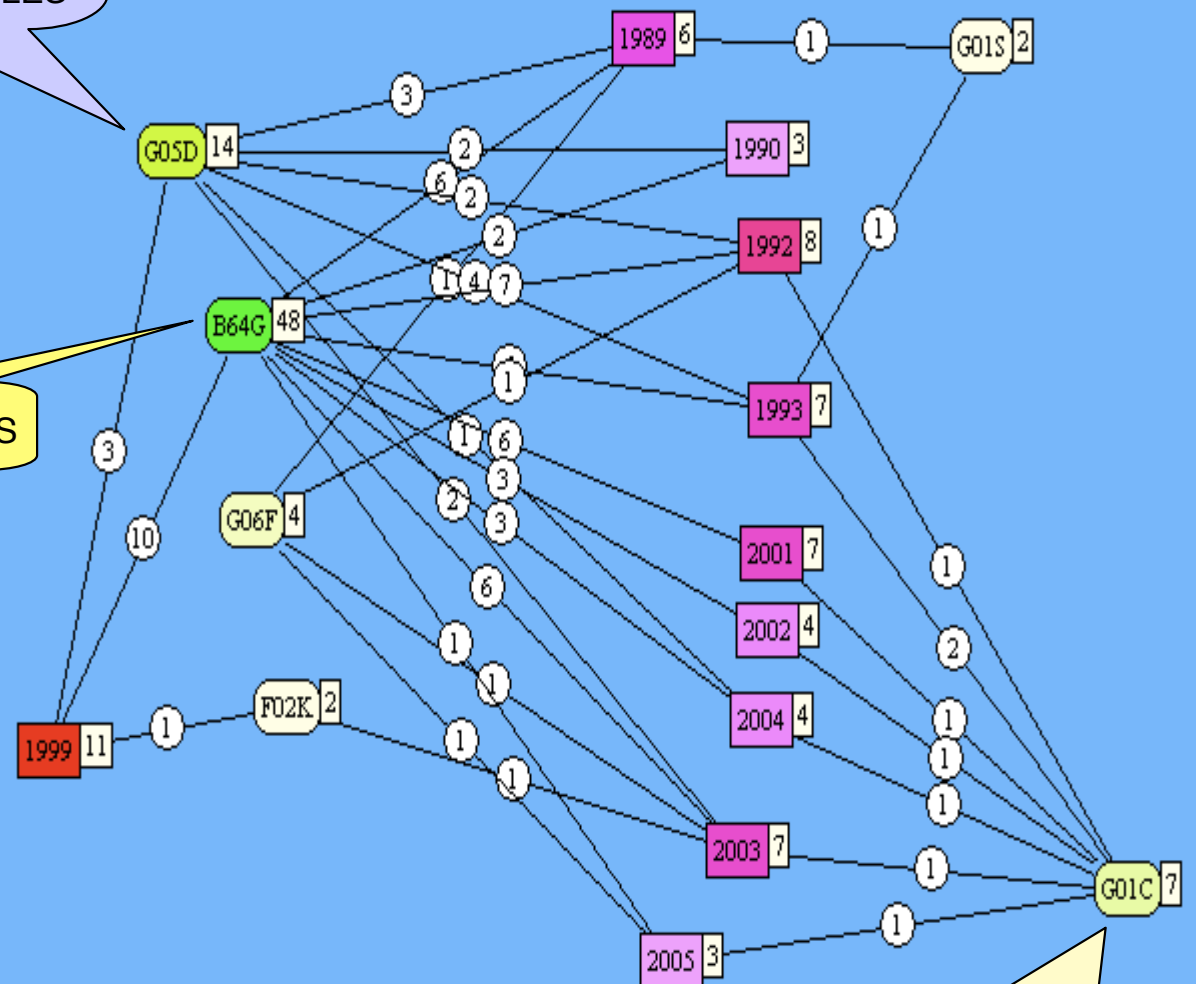
Attitude Control vs Storage/Container/Charging/Regulating Batt.

Another Way of Looking

SYSTEMS FOR
CONTROLLING OR
REGULATING NON-
ELECTRIC VARIABLES

	2005	2004	2003	2002	2001	1999	1993	1992	1990	1989	1981	1976	1972	1971	1973	1970
G06F	1		1					1		1						
B64G	1	3	6	3	6	10	6	7	2	6	1	1				
G01C	1	1	1	1	1		2	1					1			
G05D		1	2			3	4	2	2	3						
B64D		1														
B25J				1	1											
F16C				1	1											
G01P							1									
G01S							1			1						
G01B							1	1								
B64C								1								
B64B									1							
G01D														1		
G01J															1	1
F16F		1														
F03H			1													
F02K			1			1										
B64K				1	1											

COSMONAUTICS



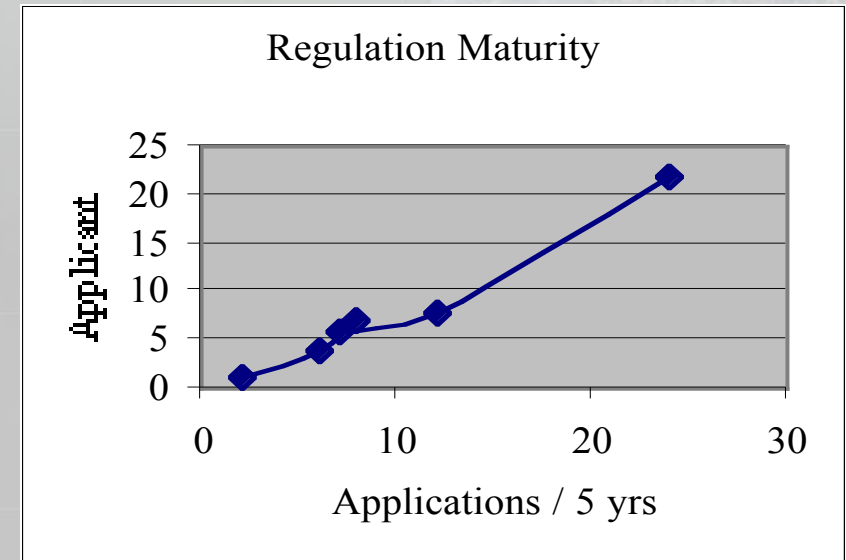
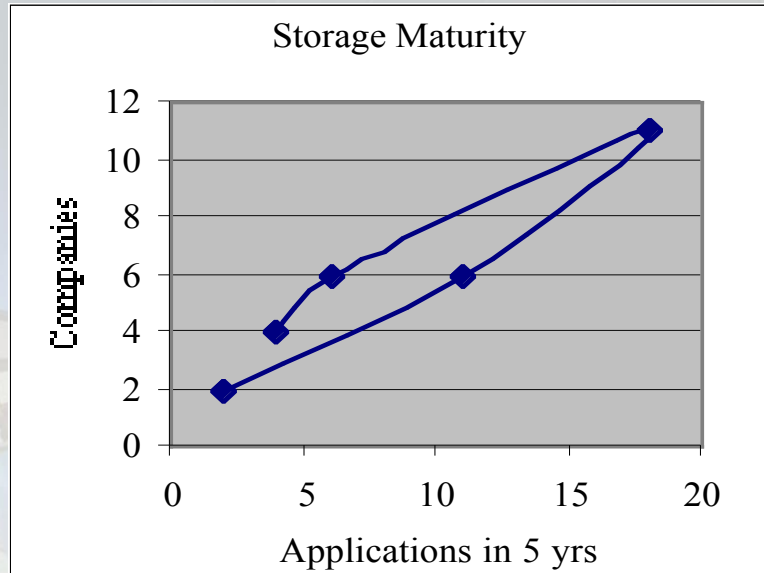
MEASURING DISTANCES, LEVELS,
OR BEARINGS; SURVEYING;
NAVIGATION; GYROSCOPIC
INSTRUMENTS; PHOTOGRAMMETRY

- The table and the graphics are from the same dataset.

A composite image featuring a space shuttle launching on the left, an astronaut in a white suit floating in the lower right, and a large view of Earth from space in the background. A faint grid pattern is overlaid on the entire image.

Maturity of Technology

Electrical Storage vs Regulation



- Looping is seen in matured technologies.
- Growing technology is indicated by a positive slope of the curve


A composite image featuring a space shuttle launch on the left, an astronaut in a white suit floating in the lower right, and a large view of Earth from space in the upper right. A faint grid pattern is overlaid on the background.

Sources of Invention

Inventor, Applicant, and Nationality

P.D. (Year) IPCIP Class (4 digits)				P.D. (Year) IPCIP Class (4 digits)				P.D. (Year) IPCIP Class (4 digits)			
IPCIP Class		ECE Class		IPCIP Class		ECE Class		IPCIP Class		ECE Class	
Groups	Family	PR. (Year)		Groups	Family	PR. (Year)		Groups	Family	PR. (Year)	
Inventors				Inventors				Inventors			
Applicants				Applicants				Applicants			
C	C...	Name	Family	C	C...	Name	Family	C	C...	Name	Family
	USA	WU YEONG-WEI A	4		USA	BOEING CO	8		USA	YOCUM JOHN F	1
	USA	LI RONGSHENG	4		USA	LORAL SPACE SYSTEMS	6		USA	WU YEONG-WEI A	4
		VAVILOV B A	3		USA	GEN ELECTRIC	6		USA	WIE BONG	1
	GER	SURAUER MICHAEL	3			TOKYO SHIBAURA ELECTRIC	3		USA	WANG HANCHING G	1
	USA	SMAY JOHN W	3		USA	HUGHES AIRCRAFT CO	3		USA	WANG H GRANT	1
	USA	PALUSZEK MICHAEL	3			RCA CORP	2		USA	WANG H G	1
	USA	NEEDELMAN DAVID I	3			NASA	2		USA	UETRECHT DAVID S	2
		FETISOV V A	3		USA	HUGHES ELECTRONICS	2		USA	TILLEY SCOTT W	2
	USA	UETRECHT DAVID S	2		USA	HONEYWELL INC	2		USA	TAKAHASHI MARC	1
	USA	TILLEY SCOTT W	2		GER	DAIMLER BENZ AEROSPACE	2		USA	SPAIN JON K	1
	USA	LIU TUNG Y	2		GBR	BRITISH AEROSPACE	2		USA	SMAY JOHN W	3
	USA	GOODZEIT NEIL E	2		USA	WIE BONG	1		USA	SLAFER LOREN I	1
	USA	GAMBLE DONALD W	2			WEL RES CO LTD	1		USA	SHANKAR UDAY J	1
		BORZOV V S	2		USA	UNIV ARIZONA	1		USA	SARTO ANTHONY	1
	GER	ZENTGRAF PETER	1		USA	TRW INC	1		USA	SAEED SALMA	1
		YOUNG RONALD WIL	1			THOMPSON RAMO W	1		USA	SACKHEIM ROBERT I	1
	USA	YOCUM JOHN F	1			SYNCHROSAT LIMITED	1		USA	RENARD GUY D	1
	USA	WIE BONG	1			SPACE ENGINEERING	1		USA	RECKDAHL KEITH	1

Invention in spacecraft attitude control mostly originates in the US. Major US companies are Boeing, Loral Space System, Hughes, RCA, and Honeywell. Etc., Etc.

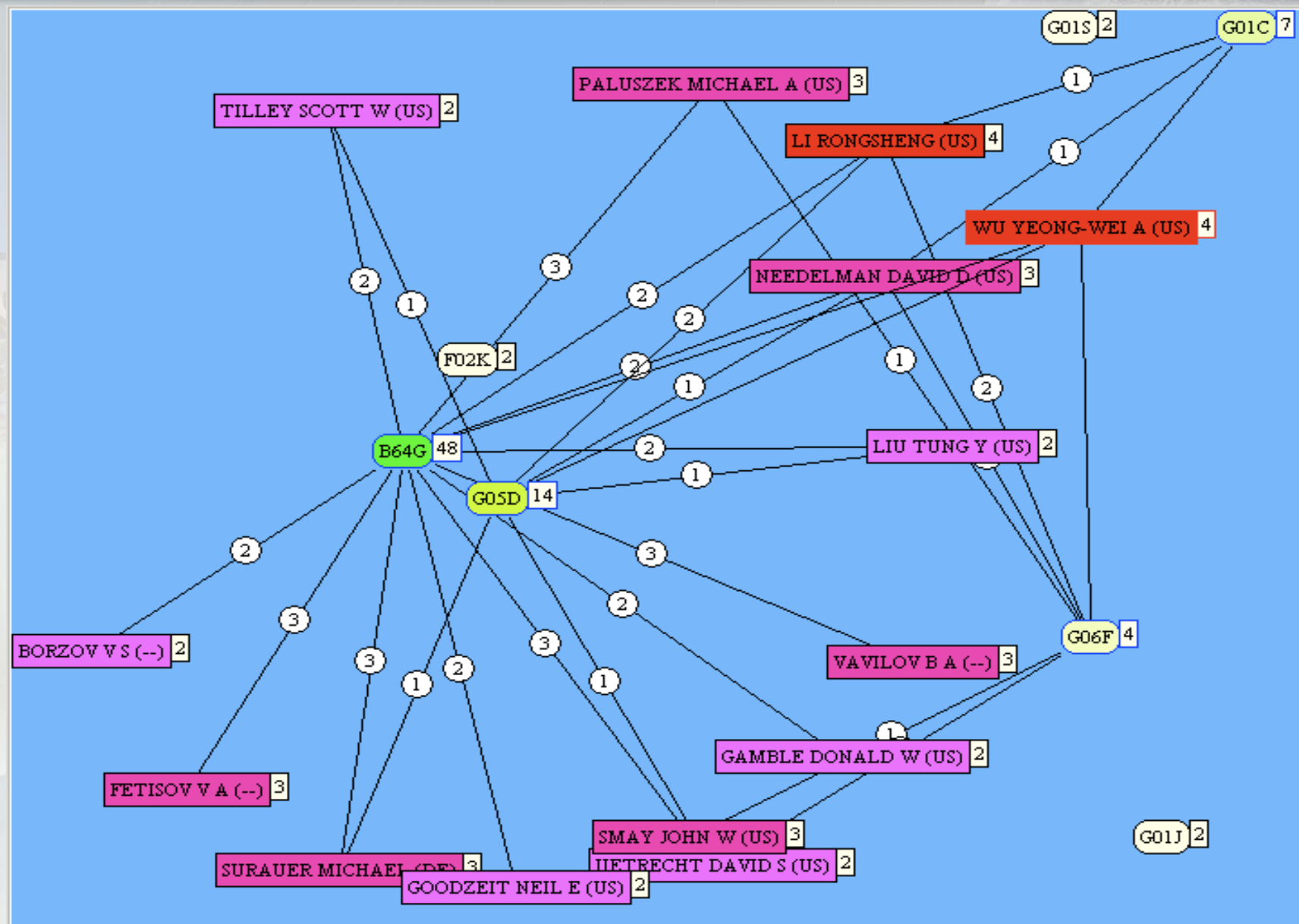
A composite image featuring a space shuttle launching on the left, an astronaut in a white suit floating in the lower right, and a large view of Earth from space in the background. A faint grid pattern is overlaid on the entire image.

Expertise Analyses

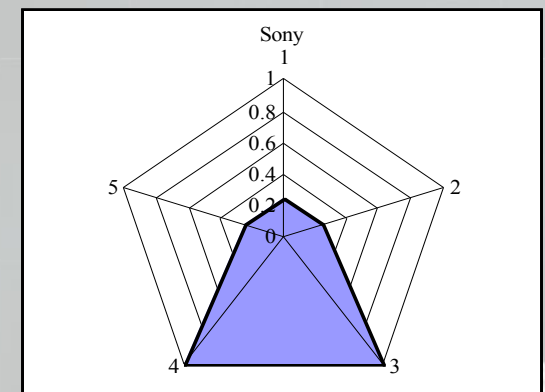
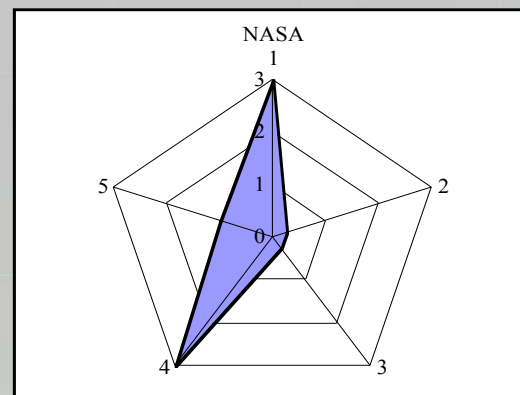
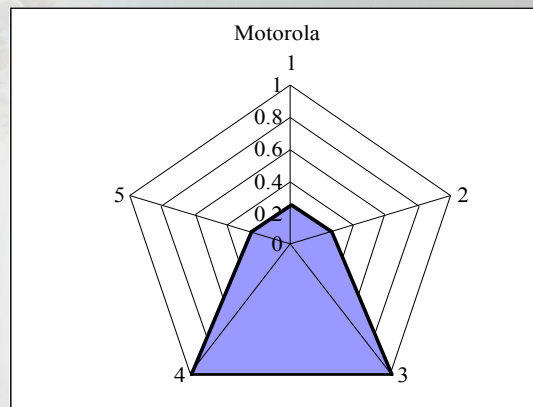
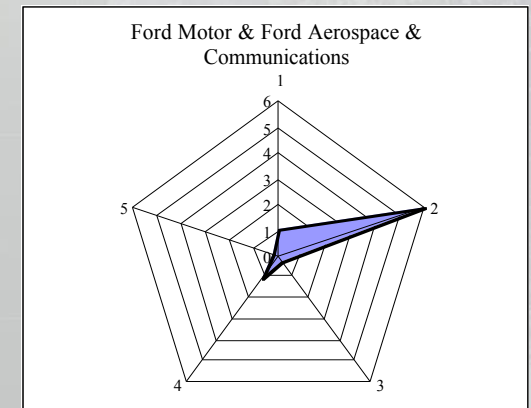
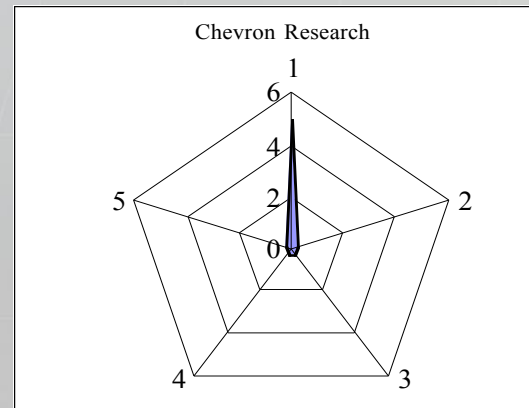
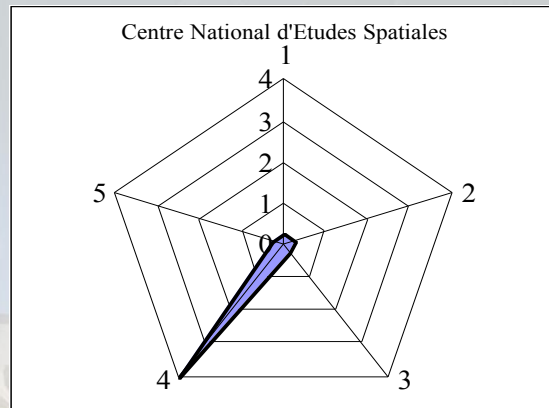
ncy

14/12/2005 Dr. Lerson Tanasugarn for MICT 35

Expertise of Inventors



Corporate Directions

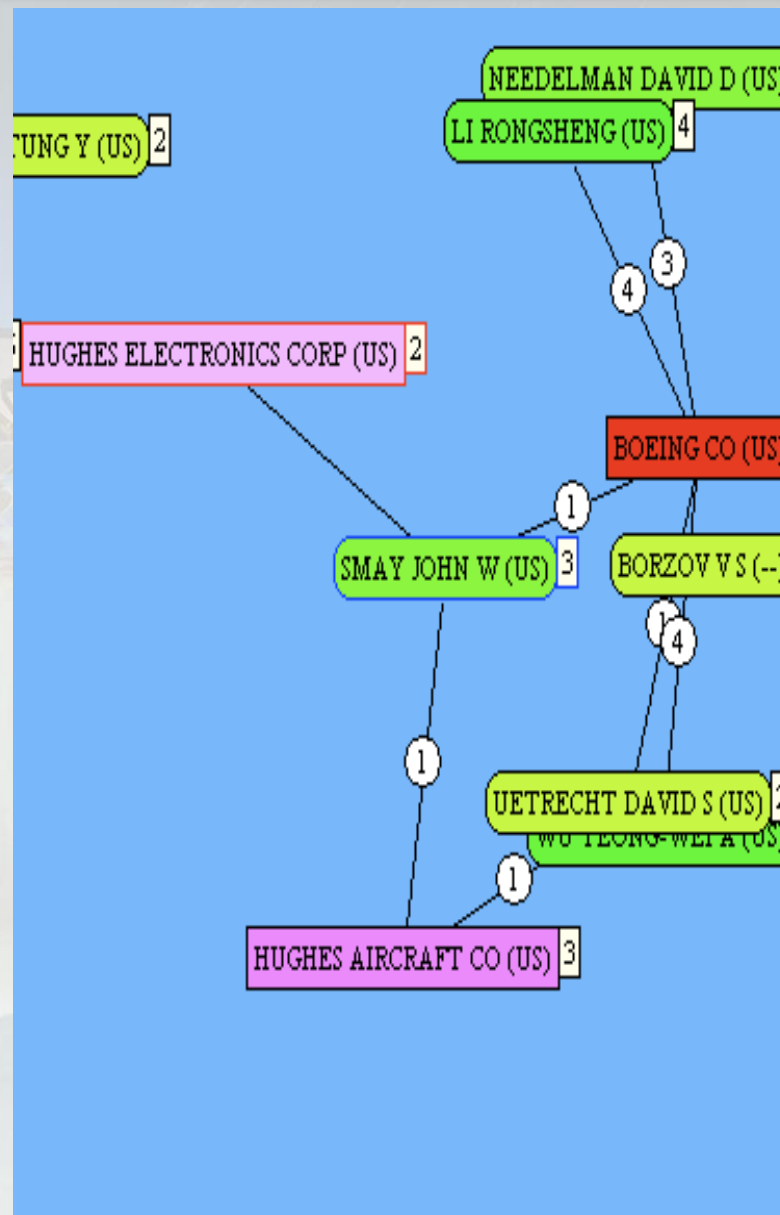


- Spacecraft Electrical Storage System
- 1=batteries, 2=housing, 3=charging, 4=regulation

A composite image featuring a space shuttle launching on the left, an astronaut in a white spacesuit floating in the lower right, and a large view of Earth from space in the background. A faint grid pattern is overlaid on the entire image.

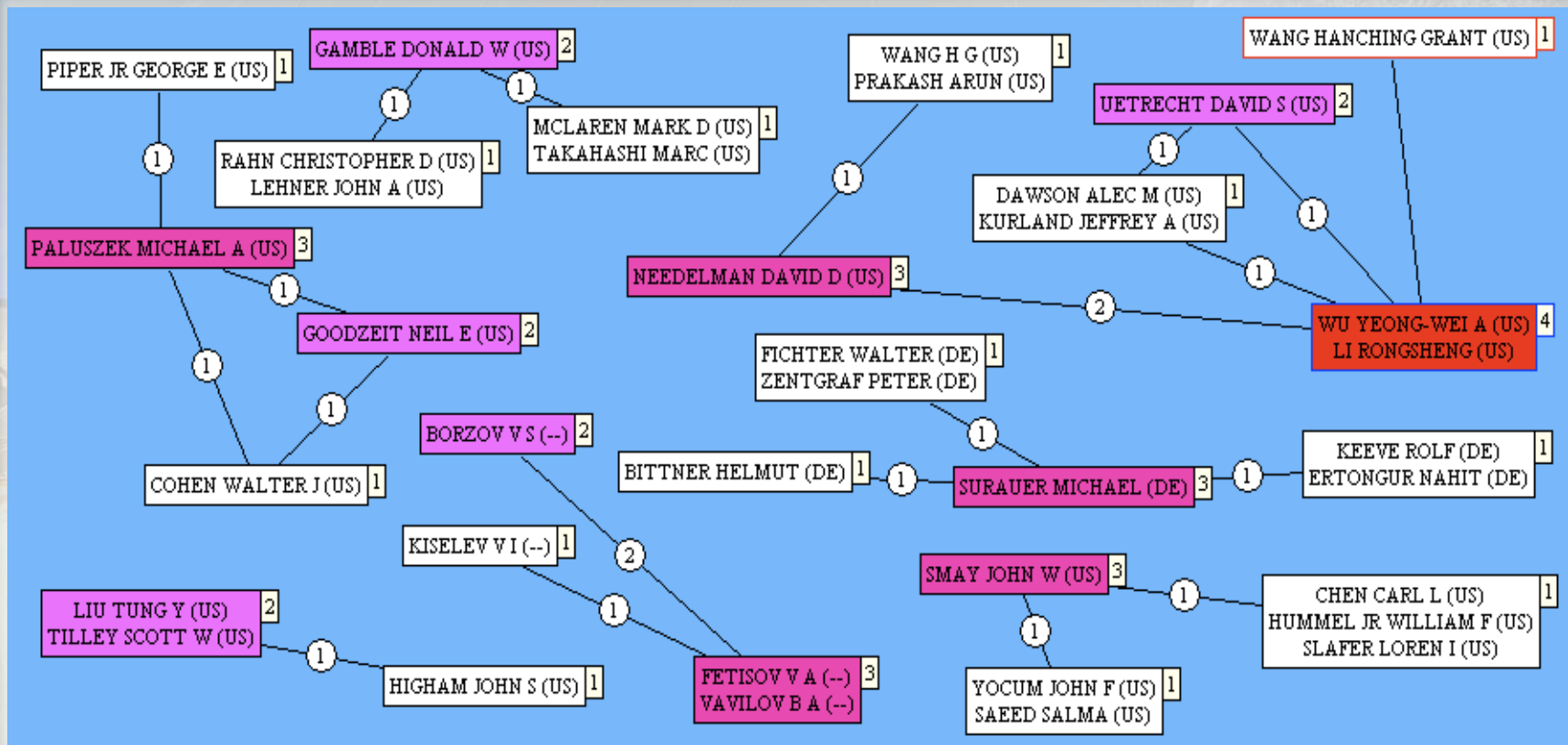
Personnel Intelligence

Corporate Affiliation of Inventors



- Network Graphics (Mattheo)
- Applicant vs Inventor
- Who is John W. Smay? Why did he invent for Boeing, Hughes Aircraft, and Hughes Electronics?

Colleagues



- Who works with whom?

DesirableFeatures (and what to do) in developing a Patent Analysis S/W

Overall

- Modular approach & concurrent development
- Participation of CS and AI specialists
- Benchmark package for each module
- Freely useable in Thailand
- Work with free and paid databases
- Multi-platform or even web-based
- Usable in areas with low-bandwidth Internet
- User may pause and resume at any time
- User-friendly, with on-line guides and tutorials for novices
- Script-based in order to update an analysis easily
- Sustainable development, with well-documented source codes and perpetual maintenance scheme

Data Access

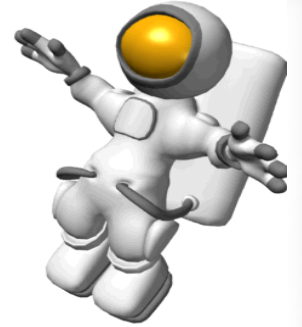
- Work with free and paid databases
- Usable in areas with low-bandwidth Internet
- Ability to pause and resume while accessing data
- Option to pre-select patents before actual loading of abstracts and full-text files
- Warning for bulk download blacklist
- Accurate prediction of download time
- Generation of adobe (acrobat) patent files
- Flexible ways of tabulating downloaded patents with several import/export formats

Data Manipulation & Analysis

- Pre-programmed analyses (e.g. Mattheo)
- Matrix and Graphics
- 3D Matrix
- 3D Maps to visualize overlapping data
- Flexible and open-ended patent exclusion criteria
- Comprehensive list of patent maps to choose from (about 30-50 types)
- Research to resolve the patent family dilemma

Patent Citations

- Forward & backward
- Check for public-domain patents
- Research novel display schemes
- Flexible patent exclusion criteria
- Convenient extraction of assignee or applicant names and background information



Text Mining

- Collaboration with AI (natural language) academics
- Participate in international patent search technology forums
- Linguistic analysis of textual data for tagging
- Grouping (segmentation) of records according to tagged data
- Explore novel technologies such as neural network models

Presentations

- Explore 3D landscape algorithms
- Graphics for relationship analysis can be rotated in 3D in order to visualize overlapping data and can be saved as movies
- Option for virtual reality (e.g. with stereo display goggles)
- Ability to add textual annotation in English and Thai

Thank You

