出國報告 (出國類別：開會)

# 出席 2023 FIG 國際測量師會員大會

服務機關：行政院農業委員會水土保持局
姓名職稱：李鎮洋局長等2人
派赴國家：美國佛羅里達州
出國期間：112 年 5 月 26 日至 112 年 6 月 3 日
報告日期：112 年 8 月 24 日

# 摘要

**出國報告名稱：出席 2023 FIG 國際測量師會員大會**

**主辦機關：行政院農業委員會水土保持局**

**出國人員姓名：李鎮洋 局長、 謝孟荃 簡任正工程司**

**出國類別：開會**

**出國期間：112 年 5 月 26 日 至 112 年 6 月 3 日**

**出國地區：美國佛羅里達州**

**內容摘要：**

行政院農業委員會水土保持局派員參加「2023 FIG 國際測量師會員大會(2023 FIG Work week)」，會議上匯聚了全球數百位測繪和地理空間資訊專家學者，水土保持局將藉由參與此次會議吸取先進國家在測繪和地理空間資訊之經驗和技術，同時也向參與會議之專家學者分享我國於土石流及大規模崩塌防災監測之相關研究成果。

本次會議主題為「Protecting Our World – Conquering New Frontiers；保護我們的世界–征服新領域」，會員大會由開幕儀式、專題演講和佛羅里達州原住民傳統表演拉開序幕，由於會議所在地位於佛羅里達州奧蘭多迪士尼園區內，本次會員大會第一場專題演講邀請在地測繪公司描述當初接受委託要在六個星期內完成佛羅里達州奧蘭多地區 12,450 英畝（約5,000餘公頃）的土地調查，如何在短時間內完成艱鉅任務之測繪方法和技術，後來才知道這一大片土地是要建置成迪士尼世界；第二場專題演講則由 FIG 主席介紹 FIG 國際測量師聯合會預定在2023年至2026年執行相關計畫，以解決全球永續發展問題，並提出行動以減少氣候變遷對環境造成之衝擊影響。

另本次會議設有廠商參展區，包括ESRI、Trimble、Leica和Bentley等知名企業展示他們在GIS和測繪技術方面的最新產品和解決方案；會議還邀請攝影測量、水域測量和土地空間與環境資訊記錄等專業人員舉辦工作坊和教育訓練課

程，深入探討測繪和空間資訊相關主題並實機操作最新GIS軟體系統。

水土保持局參與其中一場次的技術報告，該場次以「氣候變遷調適策略之挑戰與機會」為主題，本局於會中介紹我國在大規模崩塌和土石流災害預警系統方面的研究成果，並於報告後進行交流和討論，與會專家學者對我國建置完整防災資訊、有效預警機制與規劃完善氣候變遷調適策略等提出相關建議供未來再精進之參考。

本次參加「2023 FIG 國際測量師會員大會 (2023 FIG Work week)」心得及建議如下：

一、 有關地形、地景及相關地貌的測繪技術，目前已逐漸發展朝向三維立體化方式呈現虛實整合之科技，可以作為水土保持及農村發展之應用。

二、 研擬氣候變遷減緩及調適策略為本次會員大會相當重視的課題，可借鏡各國的經驗分享與會議的討論共識，做為水土保持局後續在氣候變遷調適策略研擬上之重要參考依據。

三、 本次於會員大會之廠商參展區觀摩到國際大廠研發無人機、Lidar及空間資訊軟硬體科技的實務發展與應用，吸取國際上最新的硬體技術輔助軟體決策管理建構模式，建議未來應時常關注國際重要技術產出。

四、 觀摩佛羅里達州奧西歐拉郡的祝賀城 (Celebration Town)，這是由華特迪士尼公司開發的計畫城鎮，具有完善的空間配置及智慧化基礎建設，並與周邊農業資源整合，在城鎮內營造常駐型農民市集直接販賣在地農產品，值得我國農村社區借鏡。

五、 會員大會後安排現地參訪甘迺迪太空中心 (Kennedy Space Center)，太空任務須由國家支持，然其擴及之效益為衛星資訊之應用，對於環境資源的管理有其重要的意義，在國際太空經濟蓬勃發展時可帶動我國的太空產業鏈，未來應更密切注意其發展方向。

# 目次

# 壹、參加會議目的及行程規劃

國際測量師聯合會（法語：Fédération Internationale des Géomètres；簡稱FIG）於1878年在法國巴黎成立，是聯合國和世界銀行認可的非政府國際專業組織，會員涵蓋全球測量界的所有專業領域，如各種類測量學、土地估價、地形製圖、地理資訊系統、遙感探測等，為一促進測量發展實踐和討論測量標準的國際平台。

2023 FIG 國際測量師會員大會是全球最具規模的測繪及空間資訊專業年度會議，於 112 年 5 月 28 日至 6 月 1 日在美國佛羅里達州奧蘭多舉行。本次會議主題為「Protecting Our World – Conquering New Frontiers；保護我們的世界–征服新領域」，本局於此會議上簡報「The Disaster Management of Large Scale Landslide：A Case Study of Debris Flow Early Responding Systems」，分享我國於土石流及大規模崩塌防災監測之相關研究成果，並與世界各國參與者進行交流。

本次籌組參加 2023 FIG 國際測量師會員大會，除本局派員外，另亦邀請國內研究土石流及大規模崩塌防災監測及預警決策領域之學者亦共同與會。參加人員為本局李鎮洋局長及保育治理組謝孟荃簡任正工程司出席；國內學者專家部分，則有逢甲大學地理資訊系統研究中心周天穎主任及葉美伶處長共同參與。

表1　參加 2023 FIG 國際測量師會員大會人員

| 單 位 | 職 稱 | 姓 名 |
|---|---|---|
| 行政院農業委員會水土保持局 | 局長 | 李鎮洋 |
| 行政院農業委員會水土保持局保育治理組 | 簡任正工程司 | 謝孟荃 |
| 逢甲大學地理資訊系統研究中心 | 主任 | 周天穎 |
| 逢甲大學地理資訊系統研究中心空間資訊與環境規劃處 | 處長 | 葉美伶 |

在行程規劃部分，則規劃安排 112 年 5 月 26 日出發至 6 月 3 日返國，共計

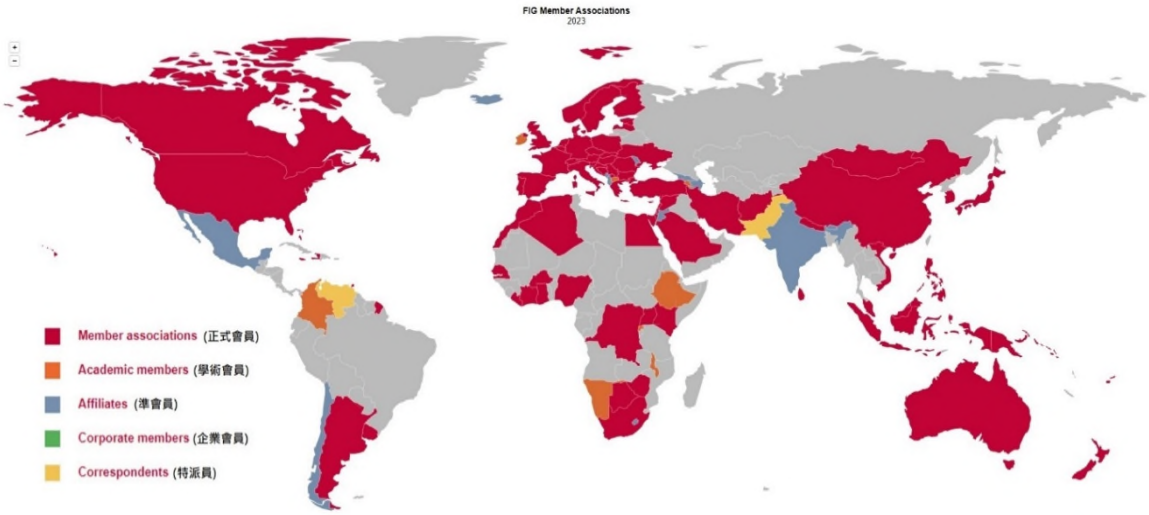
9 日，此行主要參加「2023 FIG 國際測量師會員大會 (2023 FIG Work week)」，參訪行程詳如表2。

表2 行程規劃表

| 日期 | 行程內容 | 地點 |
|---|---|---|
| 5 月 26 日<br>(星期五) | 桃園機場出發，先飛抵美國加州洛杉磯國際機場，等候轉機 | 美國加州洛杉磯 |
| 5 月 27 日<br>(星期六) | 轉乘美國國內線班機，飛往美國佛羅里達州奧蘭多機場 | 美國佛羅里達州<br>奧蘭多 |
| 5 月 28 日<br>(星期日) | 觀摩美國佛羅里達州奧西歐拉郡祝賀城 (Celebration Town) 智慧農村<br>2023 FIG 國際測量師會員大會開幕典禮 | 美國佛羅里達州<br>祝賀城、奧蘭多 |
| 5 月 29 日<br>(星期一) | 2023 FIG 國際測量師會員大會 | 美國佛羅里達州<br>奧蘭多 |
| 5 月 30 日<br>(星期二) | 2023 FIG 國際測量師會員大會 | 美國佛羅里達州<br>奧蘭多 |
| 5 月 31 日<br>(星期三) | 安排現地參訪甘迺迪太空中心 (Kennedy Space Center) | 美國佛羅里達州<br>梅里特島 |
| 6 月 1 日<br>(星期四) | 2023 FIG 國際測量師會員大會閉幕典禮 | 美國佛羅里達州<br>奧蘭多 |
| 6 月 2 日<br>(星期五) | 美國佛羅里達州奧蘭多機場出發，先飛抵美國加州洛杉磯國際機場，等候轉機 | 美國加州洛杉磯 |
| 6 月 3 日<br>(星期六) | 轉乘美國國際線班機，飛返桃園機場 | 台灣桃園 |

## 貳、參加會議過程

2023 FIG 國際測量師會員大會邀請該會各種等級會員、各國公私營部門及大專院校等專家學者齊聚美國佛羅里達州奧蘭多交流及討論最新測繪資訊及技術。FIG 國際測量師聯合會2023~2026年理事會由英國 Diane Dumashie 博士擔任主席，副主席則有5位，分別為瑞典籍 Mikael Lilje 先生、迦納籍 Kwame Tenadu 先生、香港籍 Winnie Shiu 女士、瑞士籍 Daniel Steudler 博士、美國籍 Timothy Burch 先生，目前理事會辦公室位於丹麥哥本哈根，會員計有正式會員95個、學術會員84個、準會員42個、企業會員21個及特派員5個，分布情形如圖1所示。




| | 會員等級 | 概述 | 會員現況 (2023 年 6 月) |
|---|---|---|---|
| | 正式會員(Member associations) | 代表一個或多個測量學科的國家協會，多數國家僅 1 個正式會員，少部分因專業領域不同而有 2 個以上之正式會員。 | 95 會員 (81 國家) |
| | 學術會員(Academic members) | 一個或多個測量學科教育或研究的組織、機構或團體。 | 84 會員 |
| | 準會員(Affiliates) | 從事相關專業活動，但未達到正式會員標準的測量員或測量組織。 | 42 會員 (41 國家) |
| | 企業會員(Corporate members) | 提供與測量師專業相關的商業服務的組織，機構或代理機構。 | 21 會員 |
| | 特派員(Correspondents) | 個人可被指定為一個國家的特派員，該國家沒有任何協會或測量師組織有資格加入 FIG 會員。 | 5 特派員 |

圖1 2023年6月份之 FIG 國際測量師會員分布圖

2023 FIG 國際測量師會員大會係由 Diane Dumashie 主席籌組指導委員會，負責邀請專題演講講者、各場次主持人、聯繫安排報告順序，以及邀請廠商設攤展示及規劃工作坊、教育訓練課程等，為期5天的會員大會議程如圖2所示。

**Tentative overview of the Conference Days**

| | Sunday 28 May 2023 | Monday 29 May 2023 | Tuesday 30 May 2023 | Wednesday 31 May 2023 | Thursday 1 June 2023 |
|---|---|---|---|---|---|
| Morning | Friday/Saturday/ Sunday Pre-events | Newcomers Session | | | |
| 9:00-11:00 | FIG General Assembly | Plenary session | Plenary session | Plenary session | FIG General Assembly |
| 11:00-11:30 | | Break Opening of Exhibition | Break | Break | |
| 11:30-13:00 | | Technical Sessions | Technical Sessions | Technical Sessions/ National Geodetic Survey Day / NGS | |
| 13:00-14:30 | | Lunch | | | Farewell Reception |
| 14:30-16:00 | | Technical Sessions | Technical Sessions | Technical Sessions/ National Geodetic Survey Day / NGS | |
| 16:00-16:30 | | Break | Break | Break | NSPS PAC Cornhole Event |
| 16:30-18:00 | OPENING CEREMONY | Technical Sessions | Technical Sessions | Technical Sessions/ National Geodetic Survey Day / NGS | |
| | | | Half day Technical Tours (starting at 13) | Half day Technical Tours (starting at 13) | |
| | | EXHIBITION 11:00-18:00 | | | |
| Evening | Welcome Reception (Incl. reg. fee) | Informal get-together | Commission dinners | Working Week Dinner: American Evening | FRIDAY: Golf Tournament |

圖2 2023 FIG 國際測量師會員大會議程

本次會員大會由開幕儀式、專題演講和佛羅里達州原住民傳統表演揭開序幕，專題演講第一場邀請 Beverly Hart Jones 女士講述「Surveying “ Project X” – The Boundary Survey for a secret land acquisition that became Walt Disney World」（詳附件1），說明其父親於 1964 年被交付需在六個星期內完成佛羅里達州奧蘭多地區 12,450 英畝（約5,000餘公頃）的土地調查，在當時這是個艱鉅的任務，後來才知道該土地是華特迪士尼公司要來開發建置成為迪士尼世界，藉由專題演講描述可瞭解當年測繪使用之方法與技術。

第二場專題演講則是 FIG 國際測量師聯合會 Diane Dumashie 主席講述「Serving Society, Benefitting People and the Planet：Tackling the Global Challenges」（詳附件2），簡要介紹2023至2026年間 FIG 規劃各項會議議程情形，擬朝永續發展方向邁進，以解決全球永續發展相關課題，並建議採取行動降低氣候氣變遷所帶來之環境影響。

## Keynote Presentations



**FIG President Diane Dumashie**
**SERVING SOCIETY, BENEFITTING PEOPLE AND THE PLANET: TACKLING THE GLOBAL CHALLENGES**

Diane will present the FIG's agenda for the period 2023 to 2026, which is underpinned by the need for a sustainable profession that delivers services in a sustainable manner and address the global sustainable development agenda and to act now to address the climate agenda.

As a global professional body, FIG will need to ensure that it remains relevant and maintains an influential voice at all levels to serve society, benefitting people and the planet at the same time as making sure no-one is left behind. As professionals in the land, built and natural environments, we will need to step up to ensure we remain relevant and demonstrate our resolve. This means we will all need to demonstrate:

- Clarity and collaboration – a listening and action approach
- Purpose and reliability – a visible approach
- Action and courage – working together to deliver



**Beverly Hart Jones, PSM**
**SURVEYING "PROJECT X"**
*The Boundary Survey for a secret land acquisition that became Walt Disney World*

Beverly tells the story of her father. Beverly's father was asked to prepare a survey of 12,450 acres that must be completed within six weeks. This is the story behind that survey and the additional tracts and parcels that became the 27,443 acres (11,106 ha) that we know today as Walt Disney World. It will cover a little bit of local history and the technology of the day that was used to establish the boundary lines in the woods and swamps of Central Florida almost sixty years ago and led to what, at the time, was the largest private construction project in the United States.

Beverly received her Florida Surveying and Mapping license in 1993. She is a fourth-generation Land Surveyor in Central Florida and has worked on many municipal, commercial, and residential projects. She currently leads the Subdivision Platting team at Johnston's Surveying, Inc. in Kissimmee, Florida.

圖3 專題演講講者及演講內容簡介

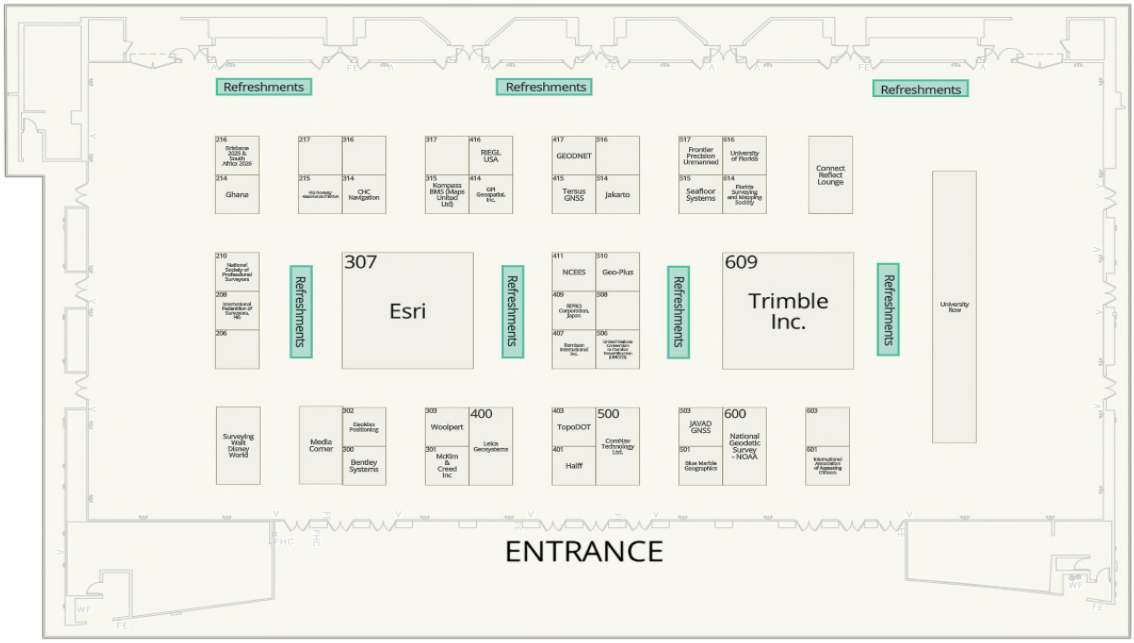
我國除本局及逢甲大學籌組參加外，另還有內政部地政司、國土測繪中心、成功大學及交通大學等專家學者亦參與此次會員大會，台灣代表團於開幕後的

歡迎茶會上，與來自世界各國人員進行互動及交流。






大會開幕次日上午為廠商參展區開幕，本次參展廠商包含ESRI、Trimble、Leica及Bentley等全球GIS及測繪技術知名企業皆參與展示，此參展區還有無人機、LiDAR及最前瞻性的軟硬體設備，對於空間資訊及測繪技術整合與感測的應用有相當之助益，展場布置及參與廠商如下圖4。




| | | |
|---|---|---|
| Surveying Walt Disney World | | 200 |
| Media Corner | | 201 |
| 航天宏图 Piesat | Beijing PIESAT Information Technology Co., Ltd | 206 |
| FIG | FIG | 208 |
| NSPS | NSPS | 210 |
| FIG Working Week 2024 Accra | FIG Working Week 2024 Accra | 214 |
| GeoForum | FIG Norway – Geoforum | 215 |
| FIG | FIG Working Week 2025 Brisbane & FIG Congress 2026 Cape Town | 216 |
| Bentley | Bentley Systems Inc. | 300 |
| McKIM&CREED | McKim&Creed | 301 |
| GEOMAX | GeoMax Positioning | 302 |
| WOOLPERT | Woolpert | 303 |
| esri THE SCIENCE OF WHERE | Esri | 307 |

| | | |
|---|---|---|
| CHCNAV Make your work more efficient | CHC Navigation | 314 |
| Kompass BMS | Kompass BMS | 315 |
| Leica Geosystems | Leica Geosystems AG | 400 |
| halff | Halff Associates, Inc. | 401 |
| TopoDOT® | TopoDOT | 403 |
| Berntsen | Berntsen International, Inc. | 407 |
| RIPRO | Ripro | 409 |
| NCEES advancing licensure for engineers and surveyors | NCEES | 411 |
| GPI | GPI Geospatial, Inc. | 414 |
| TERSUS GNSS | Tersus GNSS | 415 |
| RIEGL | Riegl USA | 416 |
| GEODNET | Geodnet | 417 |
| SinoGNSS By ComNav Technology Ltd. | ComNav Technology Ltd. | 500 |

| | | |
|---|---|---|
| BLUE MARBLE GEOGRAPHICS | Blue Marble Geographics | 501 |
| JAVAD | Javad GNSS | 503 |
| United Nations Convention to Combat Desertification | United Nations Convention to Combat Desertification (UNCCD) | 506 |
| Geo-Plus | Geo-Plus | 510 |
| JAKARTO | Jakarto | 514 |
| Seafloor | Seafloor Systems | 515 |
| FRONTIER PRECISION UNMANNED | Frontier Precision Unmanned | 517 |
| NOAA | National Geodetic Survey – NOAA | 600 |
| IAAO | International Association of Assessing Officers | 601 |
| Trimble | Trimble | 609 |
| | Florida Surveying and Mapping Society | 614 |
| ORBITS | ORBITS Engineering Firm | 615 |
| | Connect+Reflect Lounge | 617 |

圖4 廠商參展區規劃情形


FRONTIER PRECISION
GRAVADEC

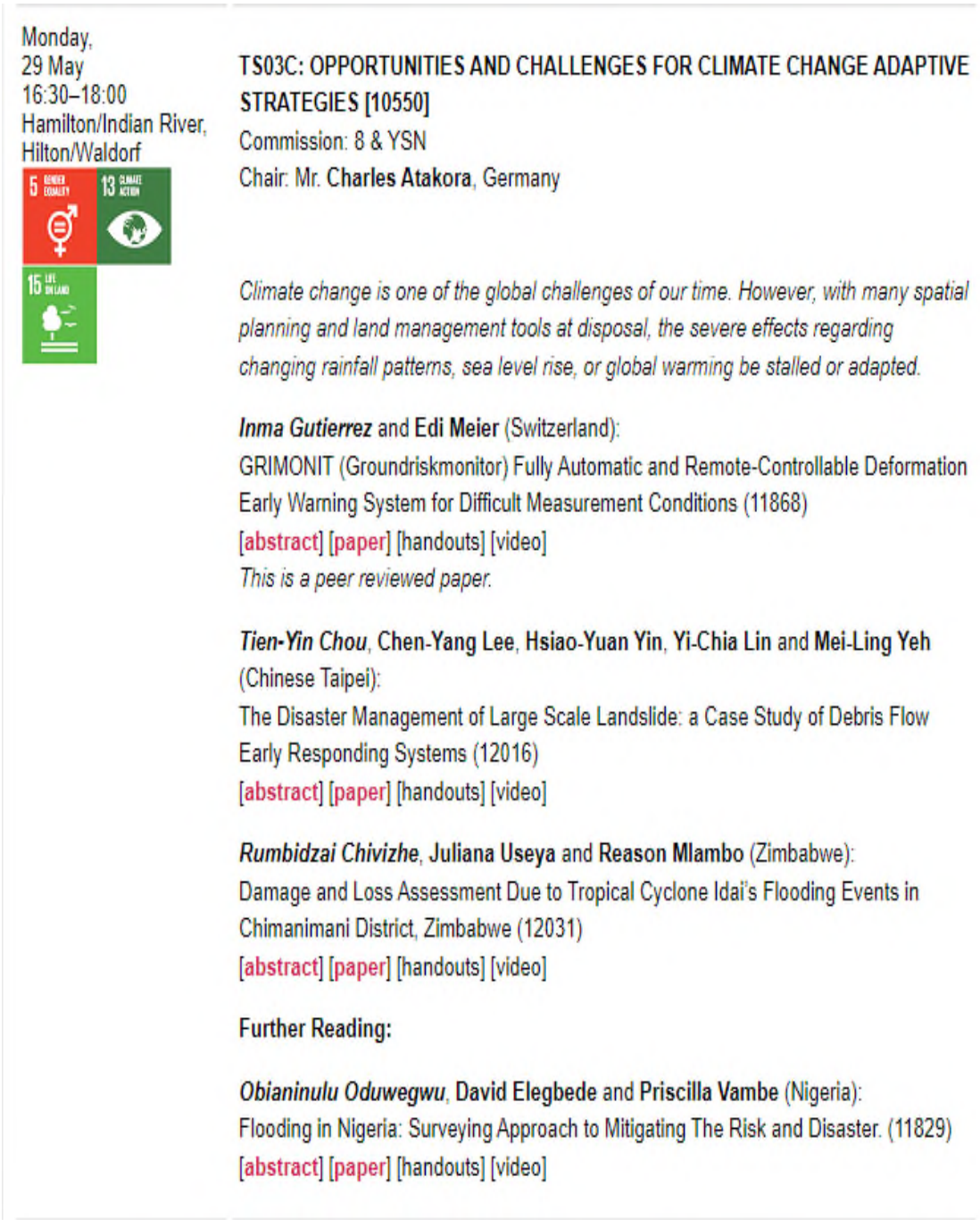

GPI
GPI
RIEGL
ULTIMATE LIDAR™ TECHNOLOGY
GPI
RIEG


esri
THE SCIENCE OF WHERE
esri
THE SCIENCE OF WHERE
rcGIS – MODERNIZING NATIONAL
IAPPING AND CADASTRE AGENCIES


WORK


GEOCNET
TAP
TAP
Tersus Adv

此次會員大會本局與逢甲大學地理資訊系統研究中心共同投稿「The Disaster Management of Large Scale Landslide：A Case Study of Debris Flow Early Responding Systems」，大會安排在5月29日下午16：30~18：00「場次8：Opportunities and Challenges for Climate Change Adaptive Strategies」報告，本局投稿文章及口頭簡報資料如附件三、四。



Monday,
29 May
16:30–18:00
Hamilton/Indian River,
Hilton/Waldorf

**TS03C: OPPORTUNITIES AND CHALLENGES FOR CLIMATE CHANGE ADAPTIVE STRATEGIES [10550]**

Commission: 8 & YSN

Chair: Mr. **Charles Atakora**, Germany

*Climate change is one of the global challenges of our time. However, with many spatial planning and land management tools at disposal, the severe effects regarding changing rainfall patterns, sea level rise, or global warming be stalled or adapted.*

***Inma Gutierrez*** and **Edi Meier** (Switzerland):
GRIMONIT (Groundriskmonitor) Fully Automatic and Remote-Controllable Deformation Early Warning System for Difficult Measurement Conditions (11868)
[abstract] [paper] [handouts] [video]
*This is a peer reviewed paper.*

***Tien-Yin Chou***, **Chen-Yang Lee**, **Hsiao-Yuan Yin**, **Yi-Chia Lin** and **Mei-Ling Yeh** (Chinese Taipei):
The Disaster Management of Large Scale Landslide: a Case Study of Debris Flow Early Responding Systems (12016)
[abstract] [paper] [handouts] [video]

***Rumbidzai Chivizhe***, **Juliana Useya** and **Reason Mlambo** (Zimbabwe):
Damage and Loss Assessment Due to Tropical Cyclone Idai's Flooding Events in Chimanimani District, Zimbabwe (12031)
[abstract] [paper] [handouts] [video]

**Further Reading:**

***Obianinulu Oduwegwu***, **David Elegbede** and **Priscilla Vambe** (Nigeria):
Flooding in Nigeria: Surveying Approach to Mitigating The Risk and Disaster. (11829)
[abstract] [paper] [handouts] [video]

圖5 「場次8：氣候變遷調適策略之挑戰與機會」場次之發表文章

本次口頭報告請逢甲大學地理資訊系統研究中心周天穎主任代表簡報，本局李鎮洋局長視需要補充說明，由於台灣位處於太平洋之地震帶，也是太平洋地區颱風侵襲的主要路徑，每年遭受颱風、豪雨及地震影響甚鉅，於是請逢甲大學協助本局建置土石流及大規模崩塌防災資訊輔助決策系統；另一方面亦隨科技發展，本局也建置各項現地環境觀測設施，有助於得到更多科學數據，客觀且具體調整所發布的警戒資訊。會議中說明本局近年所建置的土石流觀測站、大規模崩塌及各項災害預警發布機制情形，關於災害風險指認、風險分析及處置方法等亦詳細說明，以及應用 AI 技術分析各項感測資訊，於災害發生時防災訊息以紅、黃、綠燈號示警的啟動與發佈流程。

由於台灣地處災害頻仍地區，與環境共生已是全民共識，氣候變遷所帶來的影響是全球性的課題，故此項防災機制也導入國際空間資訊標準，包含感測標準、資料標準及流程機制的標準等，是台灣在氣候變遷調適策略重要的一環，也呼應本場次氣候變遷調適策略之挑戰與機會的主題。報告後，本局與在場貴賓進行交流與討論，與會各國專家學者對我國建置完整防災資訊、有效預警機制與規劃完善氣候變遷調適策略等提出相關建議，是此行最正向的收穫，寶貴建議可供本局研擬下一階段氣候變遷調適策略措施之參考依據。

會員大會其他場次亦有幾篇技術報告對於「因應全球氣候變遷減緩及調適」提出建議，充分強調對環境倡導改變的重要性，需加速建立永續發展的未來，相關口頭報告也強調了科技在推動永續發展領域中扮演重要角色。參與本次會員大會後更加瞭解國際上先進國家如何善用科技的力量，提高永續實踐效率和無限發展之創新性；另外，針對本次會員大會主題「Conquering New Frontiers（征服新領域）」部分，亦有專家學者提醒已開發國家領導者在追求科技進步和探索創新下，仍請不忘提攜開發中及未開發國家，只有世界各國能凝聚永續發展的共好目標，才能一起以改變及創新與科技推動環境永續發展並相輔相成。


FIG WORKING WEEK 2023
28 May - 1 June 2023 Orlando Florida USA
Protecting Our World, Conquering New Frontiers
The Disaster Management of Large Scale Landslide:
A Case Study of Debris Flow Early Responding Systems
Tien-Yin Chou
Director / Lifetime Distinguished Professor
GIS Research Center, Feng Chia University, Taiwan
Chen-Yang Lee
Director General, Soil and Water Conservation Bureau, Council of Agriculture, Taiwan
NSPS
esri
Trimble

# 參、其他參訪心得

## 一、觀摩佛羅里達州奧西歐拉郡祝賀城 (Celebration Town) 智慧農村及農民市集

本次行程規劃觀摩祝賀城 (Celebration Town) 智慧農村設施及當地著名的農民市集，祝賀城 (Celebration Town) 是由華特迪士尼公司開發的計畫城鎮，具有完善的空間配置及智慧化基礎建設，並與周邊農業資源整合，在城鎮內營造常駐型農民市集直接販賣在地農產品，值得我國農村社區借鏡。

1. 設計與建築

該區建築風格受到了美國東北部傳統社區的啟發，並且具有經典的美國小鎮氛圍，該社區以其精心設計的建築物、街道和公共空間而聞名，呈現出一種古典而又現代的風格。

2. 社區規劃

社區整體規劃強調永續發展、友善的步行環境和社區互動機制。該社區的街道網絡設計理念，為鼓勵居民步行或騎自行車，並提供方便的步行道和自行車道。

3. 社區活動

此社區以其豐富多樣的社區活動而聞名，經常舉辦節慶、音樂會、市集和社區聚會，讓居民和遊客能夠互相交流、享受娛樂和共享社區精神。

4. 社區設施

提供了各種社區設施，包括公園、游泳池、網球場和自行車道等。這些設施為居民提供了休閒和娛樂的場所，並促進了社區內的互動和健康生活方式。

整體而言，祝賀城 (Celebration Town) 以其獨特的建築風格、社區規劃、豐富的社區活動、商業區域和社區設施而聞名；另當地著名的農民市集 Farmer's Market at Lake Eola 不僅僅是一個市集，也是一個社區聚集的地方。這個市集提供了豐富多樣的新鮮農產品，包括水果、蔬菜、有機肉類、家禽、海鮮、蜂蜜、

乳製品等，而這些農產品通常由當地農民直接帶到社區，確保其新鮮度和品質，另外也強調支持當地農民和生產者，亦即地產地消，透過此市集提供了一個交易平台，讓當地農民和手工藝品製造商能夠展示和銷售產品，消費者能夠購買到當地獨特的農產品和手工藝品。

**二、參訪甘迺迪太空中心 (Kennedy Space Center)**

美國佛羅里達州甘迺迪太空中心 (Kennedy Space Center) 是美國航空暨太空總署 (NASA) 航太歷史上最重要的發射場之一，執行了許多重大的太空任務，包括阿波羅登月計畫和太空梭任務，其中部分設施及空間開放對外參觀，可以深入了解太空歷史、太空展品，並吸引全世界遊客前來體驗及參訪模擬太空梭和

發射設施。

甘迺迪太空中心 (Kennedy Space Center) 也肩負太空科學研究之任務，如各種火箭和探測器的發射，用於探索宇宙、行星和其他天體之科學任務。該中心亦設有許多太空科學展覽，介紹太空探索的科學和技術方面。遊客可以學習關於行星、星系、太空探測器等主題，並通過互動展示和多媒體展示了解更多有關宇宙的知識。此中心也扮演重要的太空科學環境教育場域，啟發和培養年輕一代對科學、技術、工程的興趣，推動太空探索和科學研究的進展。



# 肆、心得及建議

感謝逢甲大學地理資訊系統研究中心的協助及行程安排，本次出國參加「2023 FIG 國際測量師會員大會 (2023 FIG Work week)」心得及建議如下：

一、 有關地形、地景及相關地貌的測繪技術，目前已逐漸發展朝向三維立體化方式呈現虛實整合之科技，可以作為水土保持及農村發展之應用。

二、 研擬氣候變遷減緩及調適策略為本次會員大會相當重視的課題，可借鏡各國的經驗分享與會議的討論共識，做為水土保持局後續在氣候變遷調適策略研擬上之重要參考依據。

三、 本次於會員大會之廠商參展區觀摩到國際大廠研發無人機、Lidar及空間資訊軟硬體科技的實務發展與應用，吸取國際上最新的硬體技術輔助軟體決策管理建構模式，建議未來應時常關注國際重要技術產出。

四、 觀摩佛羅里達州奧西歐拉郡的祝賀城 (Celebration Town)，這是由華特迪士尼公司開發的計畫城鎮，具有完善的空間配置及智慧化基礎建設，並與周邊農業資源整合，在城鎮內營造常駐型農民市集直接販賣在地農產品，值得我國農村社區借鏡。

五、 會員大會後安排現地參訪甘迺迪太空中心 (Kennedy Space Center)，太空任務須由國家支持，然其擴及之效益為衛星資訊之應用，對於環境資源的管理有其重要的意義，在國際太空經濟蓬勃發展時可帶動我國的太空產業鏈，未來應更密切注意其發展方向。

伍、附件

附件一、**2023 FIG** 國際測量師會員大會 **– 專題演講 I**

附件二、**2023 FIG** 國際測量師會員大會 **– 專題演講 II**

附件三、**2023 FIG** 國際測量師會員大會 **–** 投稿文章

附件四、**2023 FIG** 國際測量師會員大會 **–** 簡報資料

FIG Working Week 2023

# FIG WORKING WEEK 2023

28 May - 1 June 2023 Orlando Florida USA

Protecting Our World, Conquering New Frontiers

# SURVEYING "PROJECT X"

## The Boundary Survey for a secret land acquisition that became Walt Disney World

Beverly Hart Jones, PSM


Organized By NSPS FIG INTERNATIONAL FEDERATION OF SURVEYORS

Diamond Sponsors esri THE SCIENCE OF WHERE Trimble


A. C. Hart - Old Dixie Highway at the Orange and Osceola County line, 1920's
*(Florida Archives)*

SPHALER'S ADDITION
TO
PROSPER COLONY

South Range 29

The N.W.¼ of the N.W.¼ The N.E.¼ of the N.W.¼ - The N.W.¼ of the N.E.¼
The N.E.¼ of the N.E.¼ and The N.½ of the S.W.¼ of the N.W.¼ - The N.½ of
The S.E.¼ of the N.W.¼ - The N.½ of the S.W.¼ of the N.E.¼ and the N.½ of
S.E.¼ of the N.E.¼ of the N.1st & 2nd Quarters of Section 2, 5 s. Parms.

Township 24

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 311.8 | 331.8 | 331.8 | 311.8 | 311.8 | 331.8 | 331.8 | 311.8 | 311.8 | 331.8 | 331.8 | 311.8 | 311.8 | 331.8 | 331.8 | 311.8 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| 311.8 | 331.8 | 331.8 | 311.8 | 311.8 | 331.8 | 331.8 | 311.8 | 311.8 | 331.8 | 331.8 | 311.8 | 311.8 | 331.8 | 331.8 | 311.8 |

Prosper Colony Lands.

State of Florida
County of Orange

Personally appeared before me A.C.Hart Surveyor who being duly sworn deposes and says that the above is a correct survey of the above described land.

A. C. Hart.

Sworn to and subscribed before me this 19th day of Jany 1915.

F. H. Shine.
Notary Public, State at Large.
My commission expires Jan.13/18.

(Notarial Seal)

State of Florida
County of Orange

Personally appeared before me D.B.Sphaler who being duly sworn deposes and says that he is the owner of the above described lands.

Sworn to and subscribed before me this 19th day of Jan. 1915.

D. B. Sphaler.

(Ct. Ct. Seal) B. M. Robinson Clerk Ct Ct
By J. P. Williams D.C.

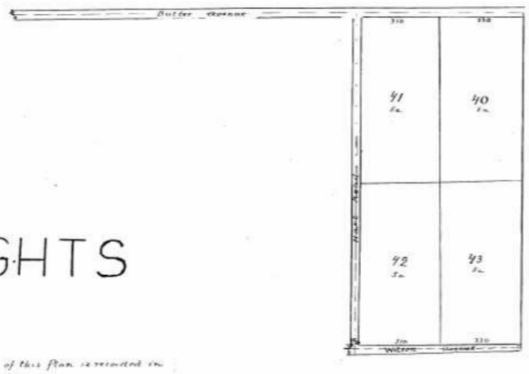
2-24-29

FILED AND RECORDED THIS 19th DAY OF JANUARY A.D. 1915.

B. M. Robinson Clerk
By J. P. Williams D. C.

# PLAN
## of
# LAKEVIEW HEIGHTS

Orange County
Florida




This Correction of this Plan is recorded in Plat book E pages 39 & 40 Office B. M. Robinson Clerk By J. P. Williams D.C.

Subdivision of

| Description | Section | Township | Range | Acres |
|---|---|---|---|---|
| W½ | 27 | 22 | 28 | 320 |
| W½ of SW¼ of SE¼ | 27 | 22 | 28 | 20 |
| E½ of SE¼ | 28 | 22 | 28 | 80 |
| NW¼ of SE¼ | 28 | 22 | 28 | 40 |
| N½ of NE¼ of SW¼ | 28 | 22 | 28 | 20 |
| S½ of SE¼ of NW¼ | 28 | 22 | 28 | 20 |
| NE¼ of SE¼ of NW¼ | 28 | 22 | 28 | 10 |
| N½ of NW¼ | 33 | 22 | 28 | 80 |
| | | | | 590 |

Note
Roads and Avenues included in acreage
Boulevard around shore of Lake to be 80 ft. wide

Personally appeared before me Walter W Rose who deposes and says that he is the Secretary of the Lake View Heights company and that said Company is the owner of above described property

Walter W. Rose
Secretary

Sworn to and subscribed before me this 13th day of July 1914

M. P. Hart
Notary Public State at Large
(Notarial seal) My commission expires 4-15-17

Personally appeared before me A.C.Hart who deposes and says that this plan is a Preliminary survey of the above described lands

Sworn to and subscribed before me this 13 day of July 1914

M. P. Hart
Notary public State at Large
(Notarial seal) My commission expires 4-15-17

A.C. Hart Surveyor
& Draughtsman

A.C. Hart
Surveyor
Orlando, Fla.
Scale 1 inch = 200' June 10th 1914

Filed in office and Recorded in Platbook E pages 32-33, this 14 day of July 1914

B. M. Robinson
Clerk Ct. C.t
(Ct Ct Seal) By J. P. Williams D.C.

THE FLORIDA

Society of Professional Land Surveyors

THIS IS TO CERTIFY THAT

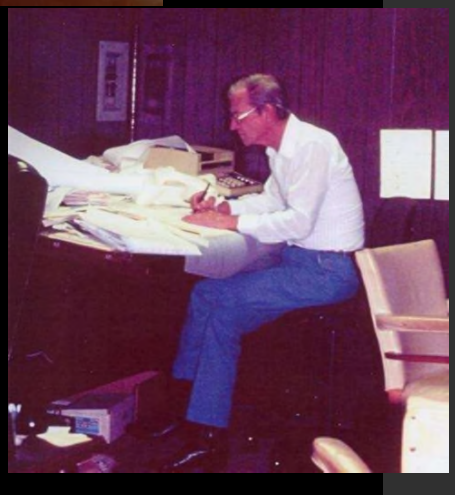
WILLIAM C. HART

IS ENTITLED TO ALL THE RIGHTS AND PRIVILEGES OF THE ASSOCIATION IN THE GRADE OF

Charter Member

12/31/68
EXPIRES

SECRETARY TREASURER



# William C. "Bill" Hart

**1973 ASP/ACSM**

**TECHNOLOGY TODAY AND TOMORROW**

**FALL CONVENTION**

**OCTOBER 2-5**

**Walt Disney World**

LAKE BUENA VISTA, FLORIDA

## *Surveyor In Like Breeze*

WILLIAM C. HART, 42, Democrat, Windermere, married, two children, B.S. in Engineering, Veteran county surveyor for 14 years, incumbent, unopposed. Graduate Indiana Technical College.

Form 102

**CERTIFICATE OF NOMINATION**

STATE OF FLORIDA,
County of ORANGE

Office of
SUPERVISOR OF REGISTRATION

Orlando, Fla., May 20, 19 54

This is to certify that Honorable Wm. C. Hart

was nominated as the Democratic candidate for the office of County Surveyor

in and for Orange County,

at the Primary Election held on the 4th day of May 20, 19 54, having received the highest number of votes for said office at said election, as shown by the Election Returns on file in my office.

Dixie P Barber
Supervisor of Registration.

WM. C. HART

COUNTY SURVEYOR

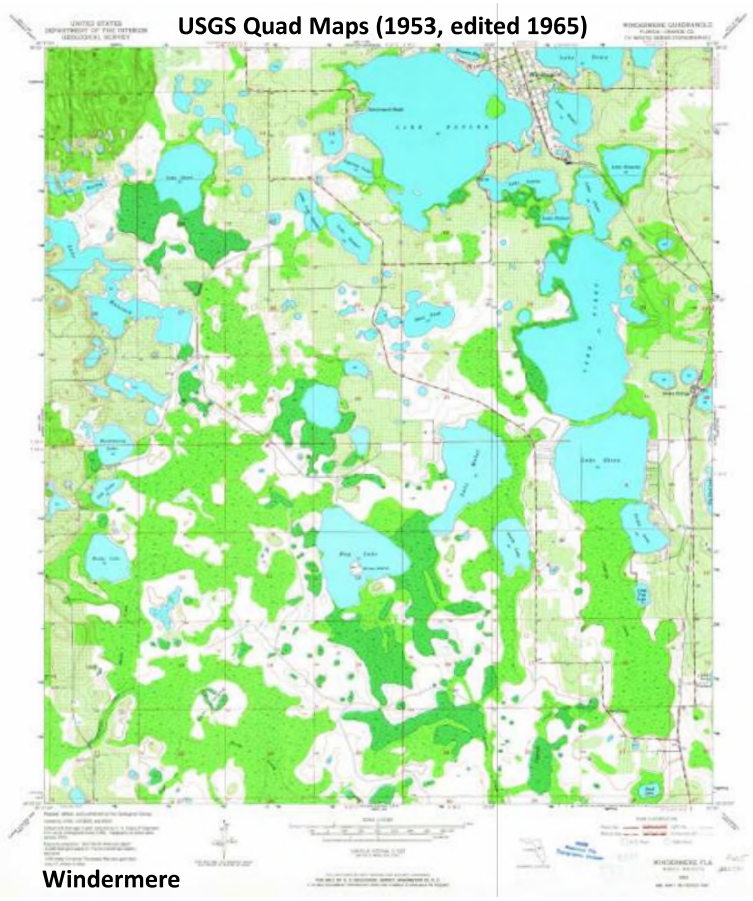
827 HIGHLAND AVE. - ORLANDO, FLORIDA 32803, PH. 422-4334

| DATE: OCT. 24, 1967 | SCALE: 1" = 1000' | DWG. NO: 67-771 |
|---|---|---|

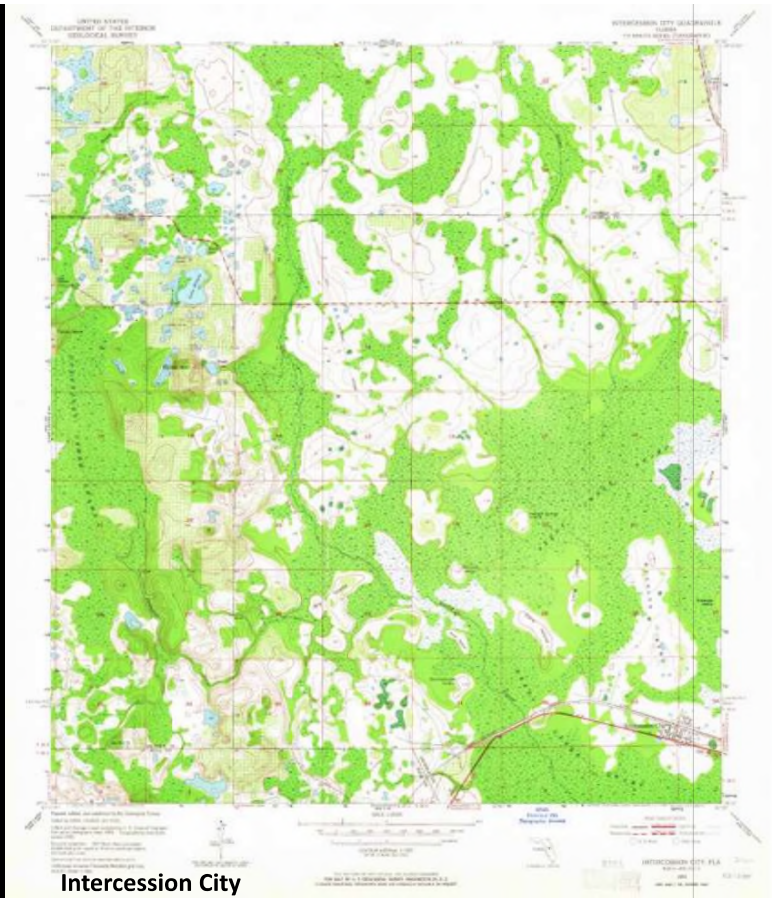
Disneyland
Anaheim,
California

Aerial Photos, Florida Archives

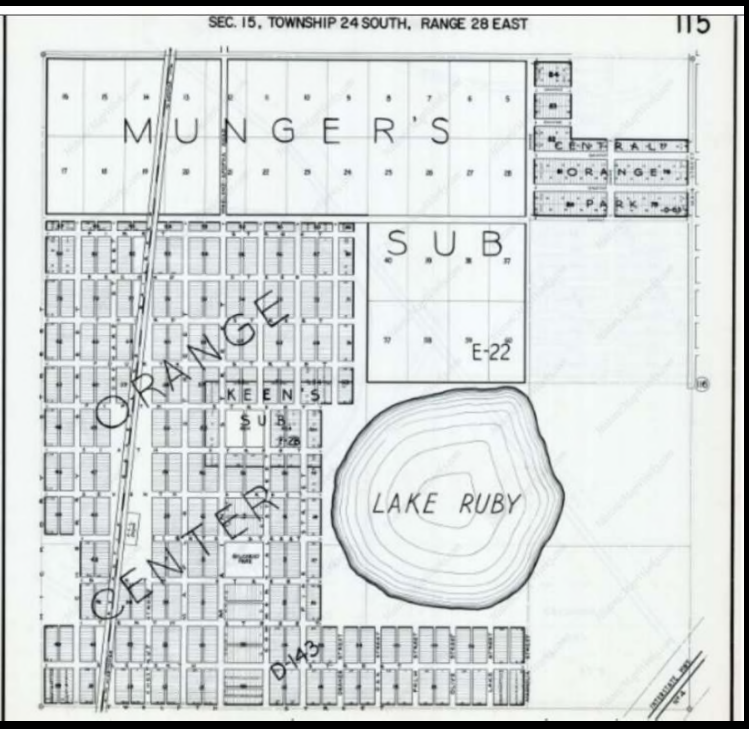
USGS Quad Maps (1953, edited 1965)



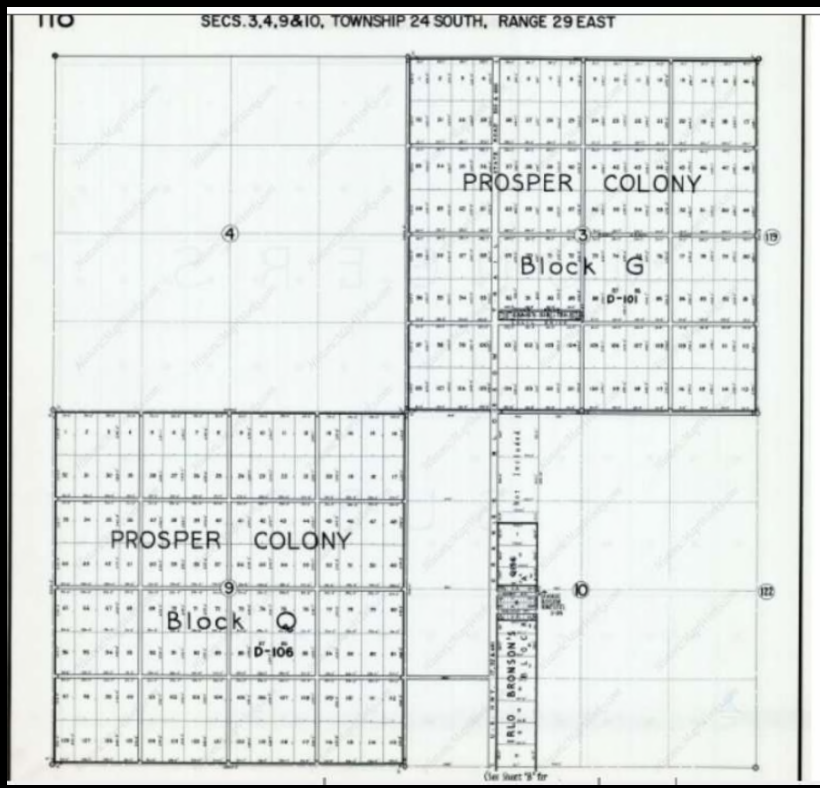
Windermere

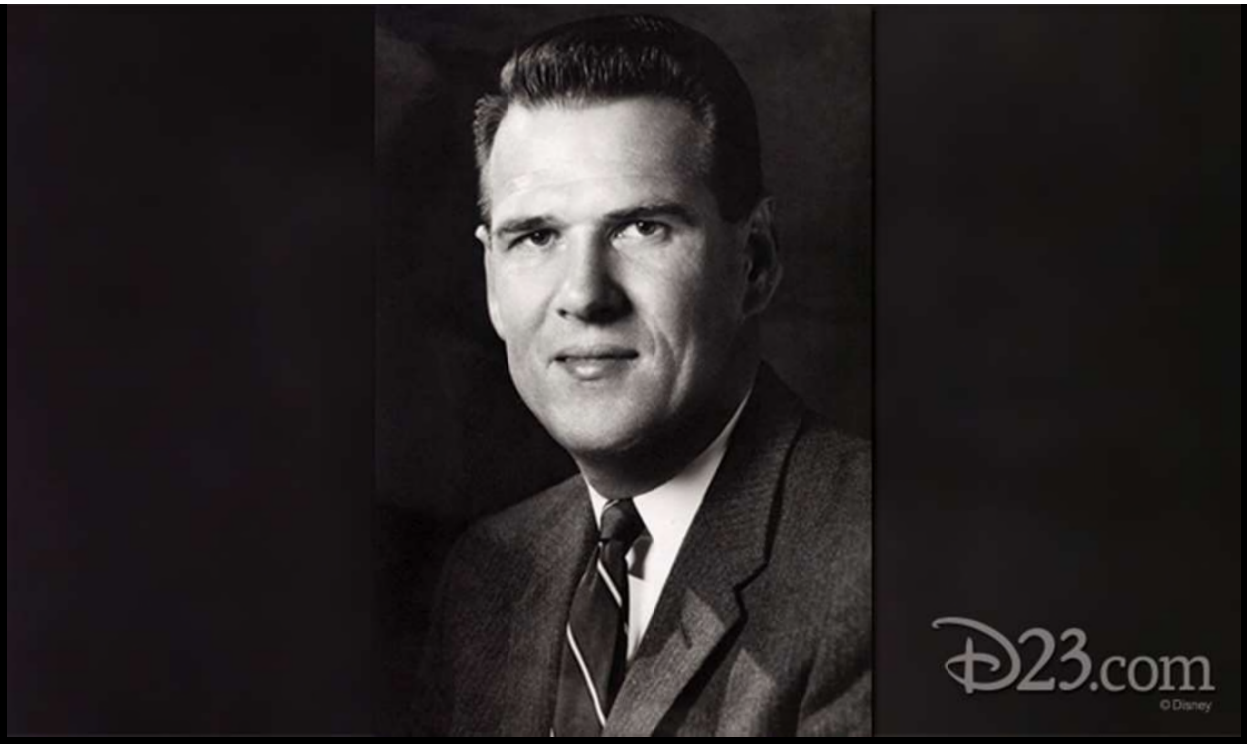


Intercession City



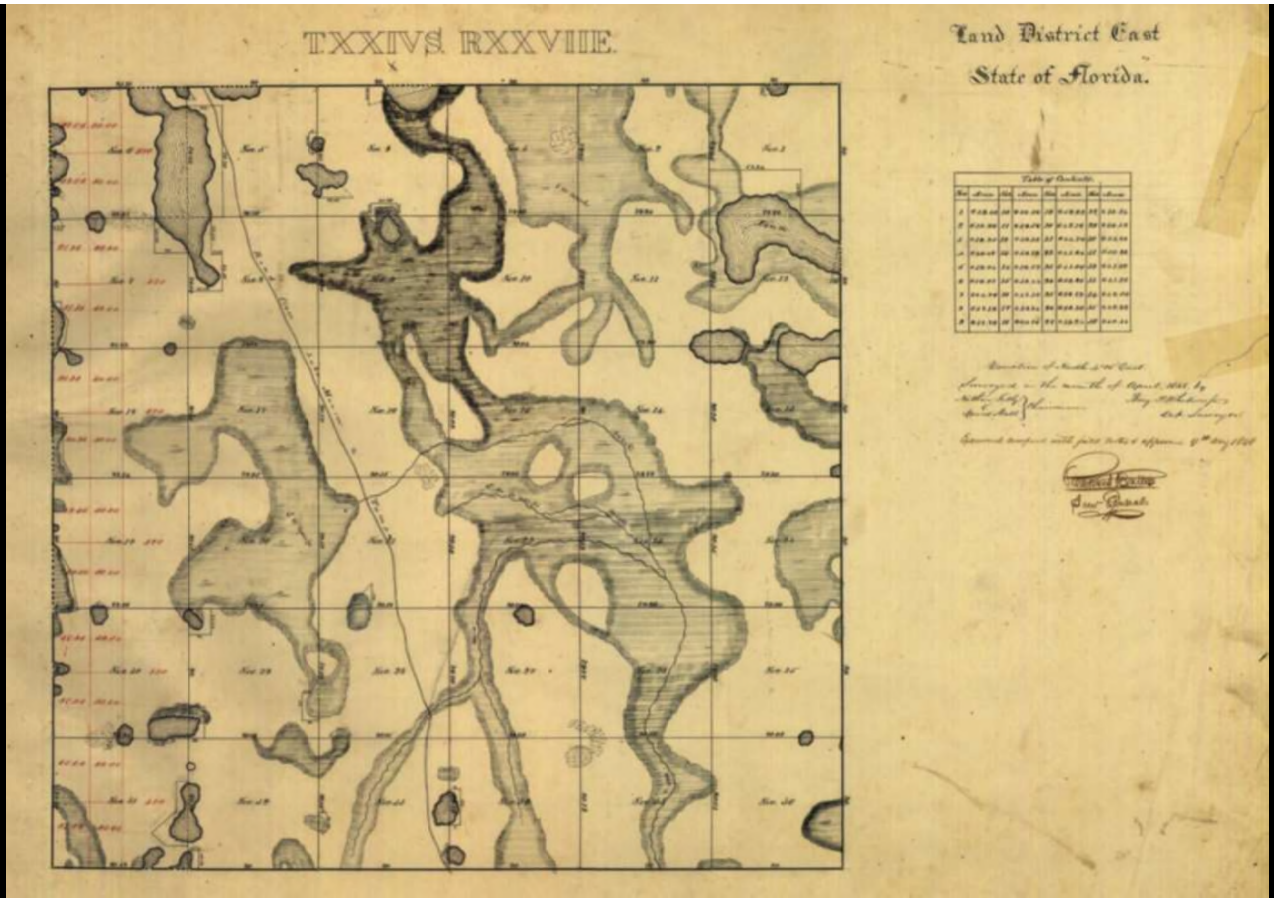

1962 Tax Maps – Subdivision Atlas



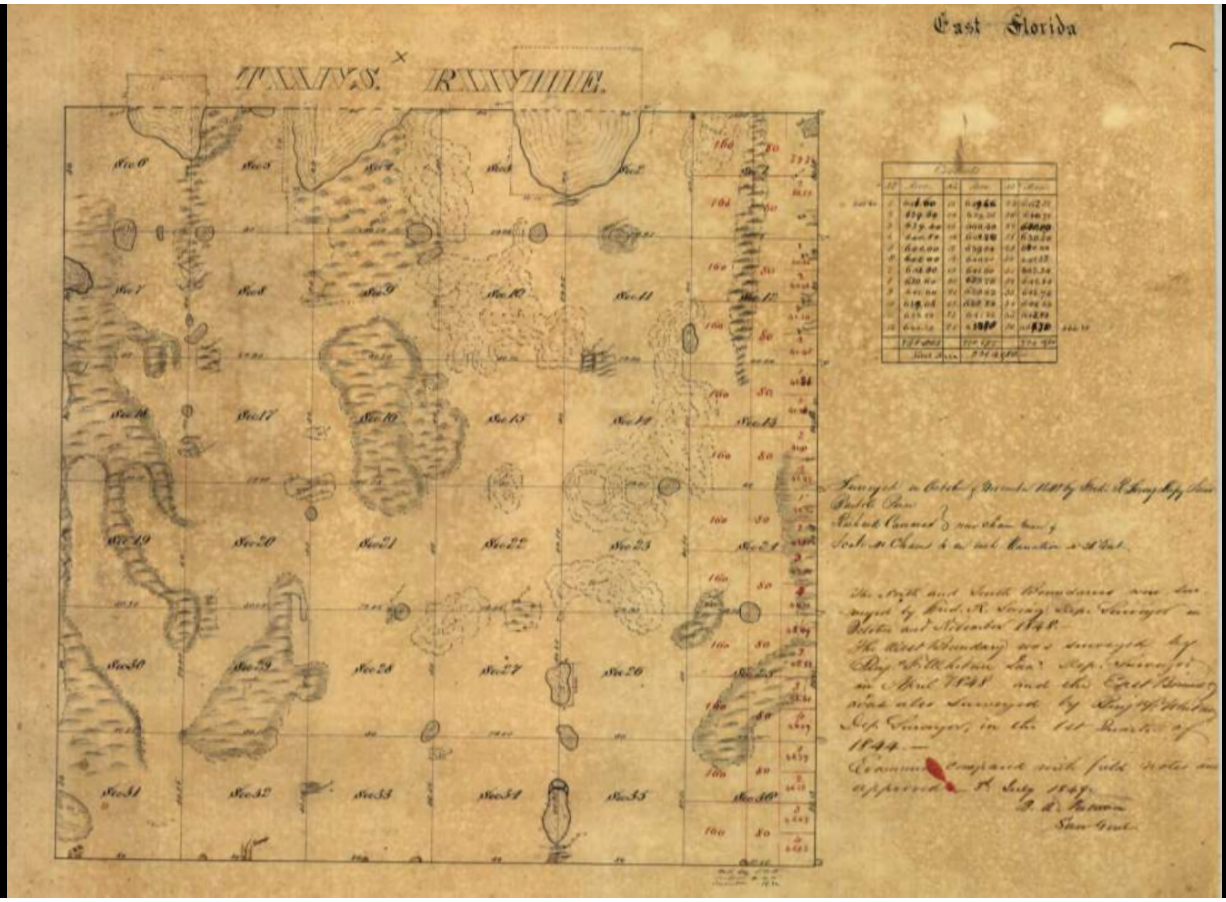



Disney Legend, Robert “Bob” Foster AKA “Bob Price”

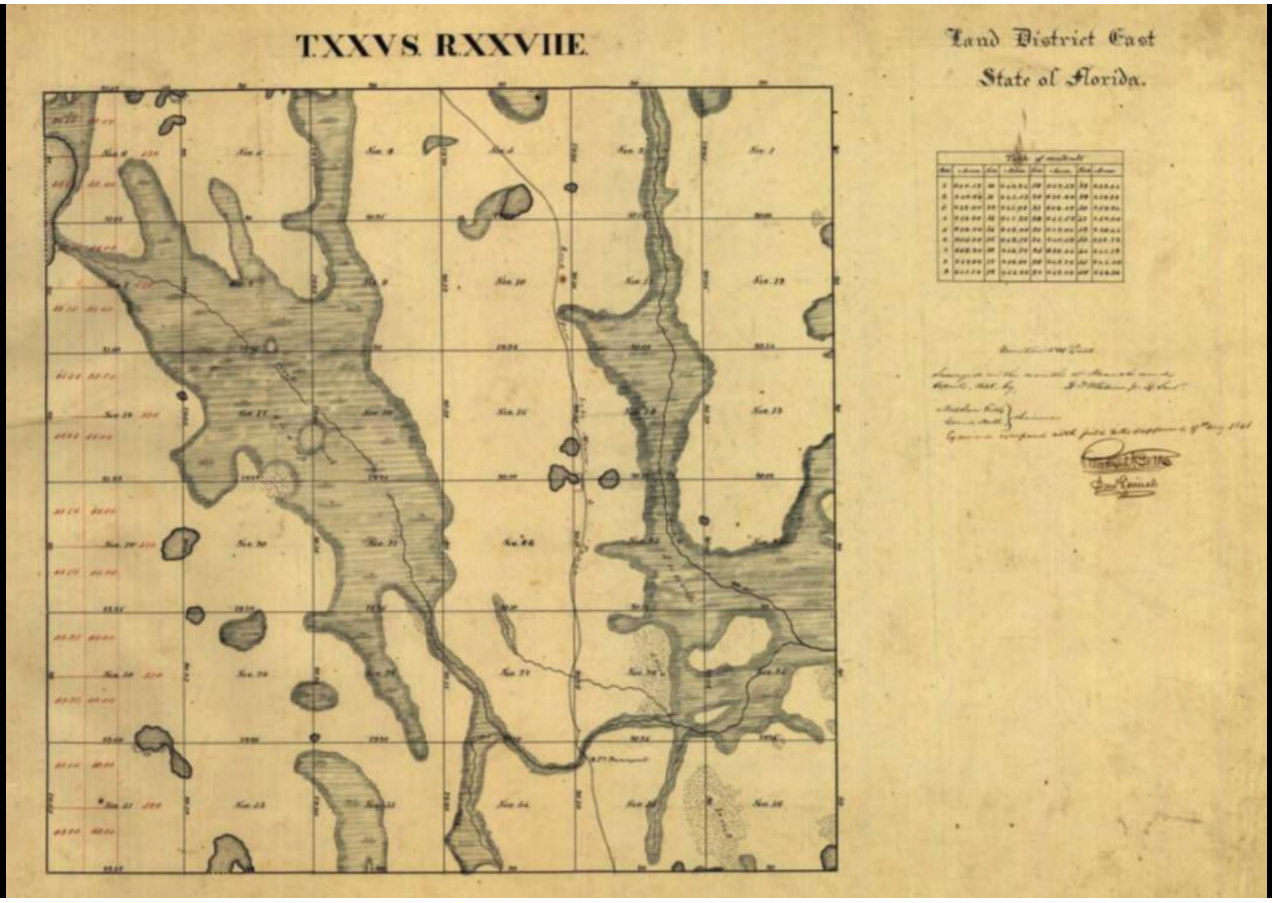
Township Maps



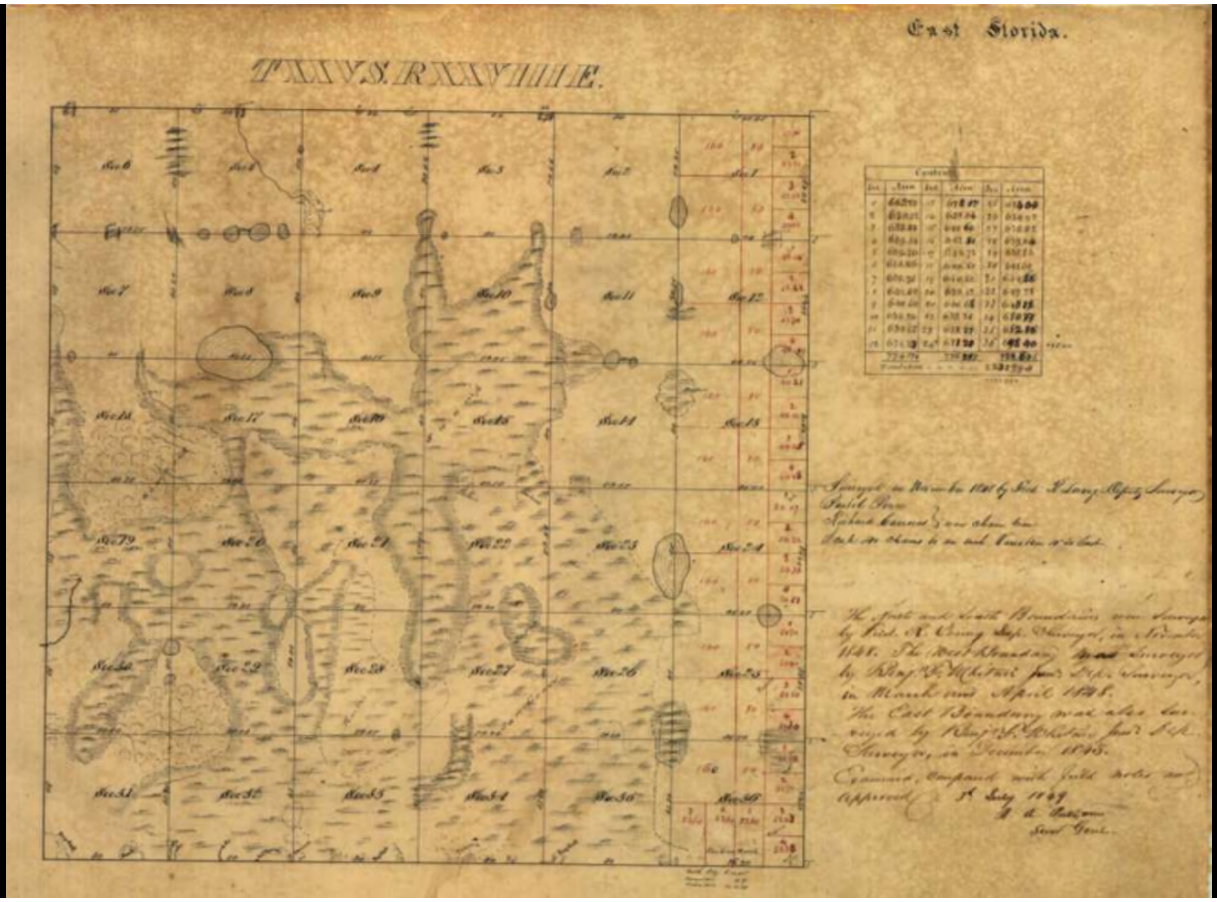
Township Maps



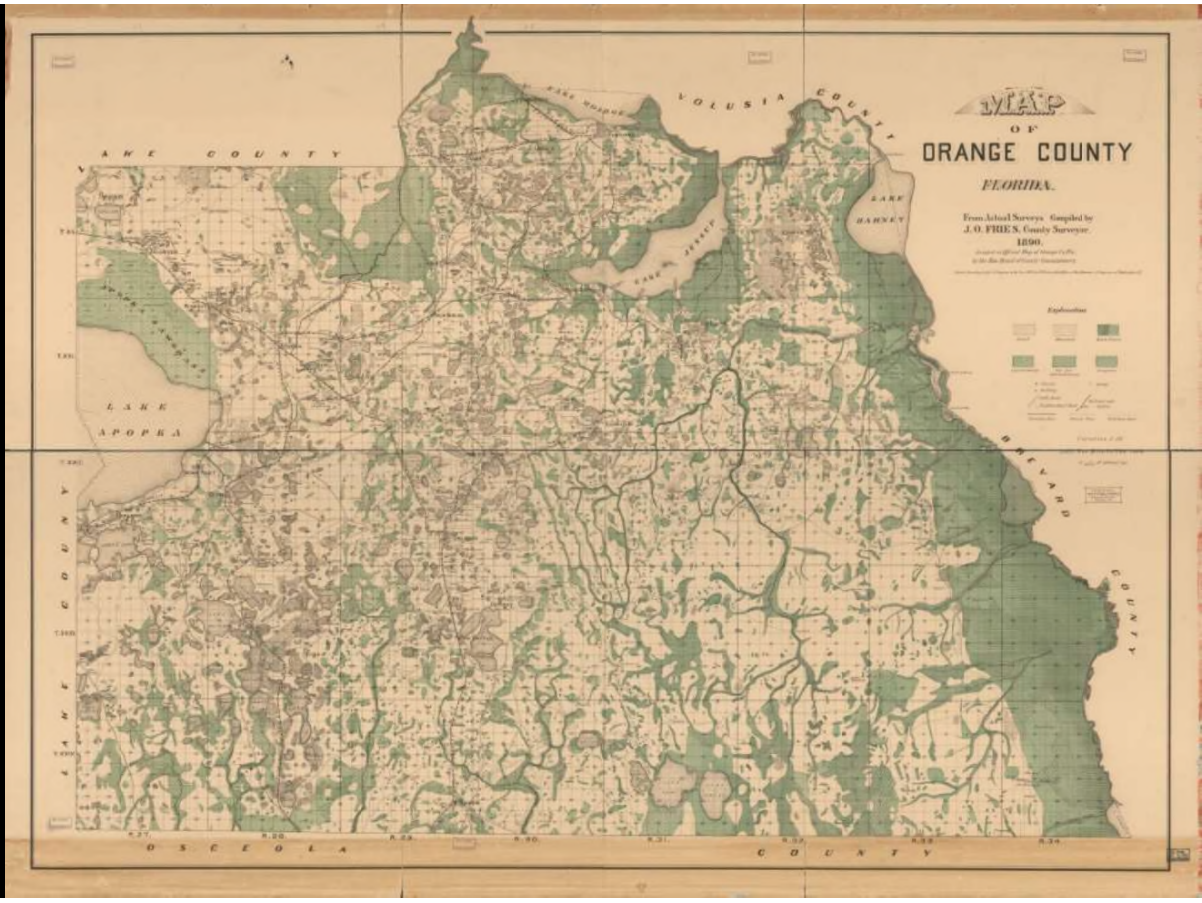

Township Maps



Township Maps




J. O. Fries Map of Orange County, Florida
1890



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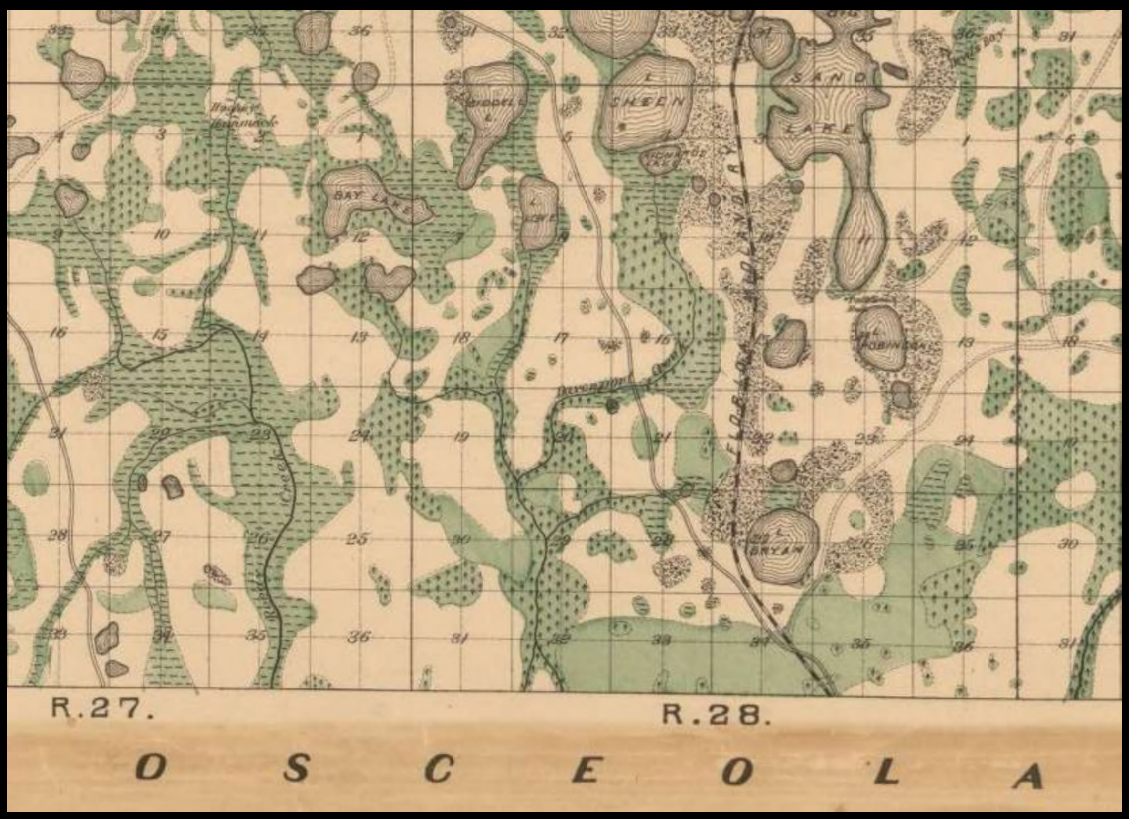
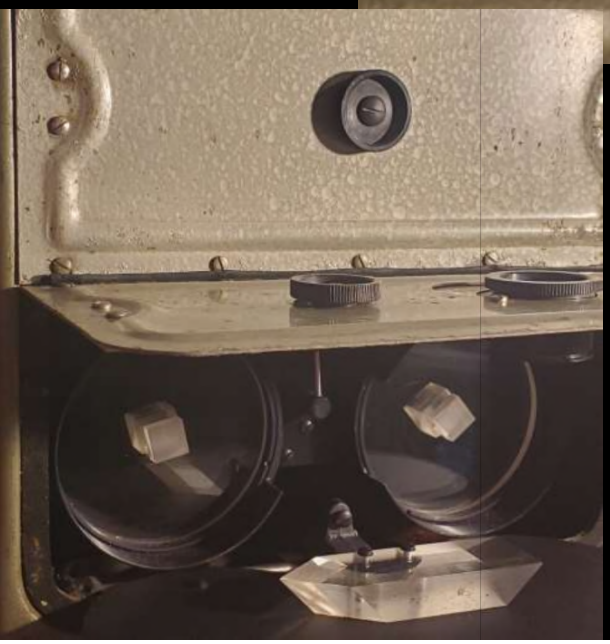




AGA
STOCKHOLM
SWEDEN
X590315
417
NASM-4B




AGA

Orlando Sentinel

# Real Estate-Financial

Land Sales... Building News
Area Business

SECTION B
Sunday
July. 4. 1965

## 'Space Age' Devices Set Surveying Record

BILL HART AND GEODIMETER PART
... unit receives reflected light to measure

## 12,450 Acres Measured In Six Weeks

What does a surveyor do when he has to survey 12,450 acres in just six short weeks?

That was the question facing Bill Hart, County Surveyor, when Florida Ranch Lands, Inc., told him to submit a proposal for a survey on the Deseret property in southeast Orange County.

**BECAUSE** the purchase of the property by undivided principals for a major "mystery plant," depended upon an accurate survey in relatively short time, it was obvious to Hart that the time-honored transit and "chain gang" measurement was out.

The only answer: surprise electronic instrument developed in Sweden which offered accuracy not obtainable by normal surveying means and — more important — speed.

"So I took a deep breath and ordered a Geodimeter," said Hart, "and then realized that to use it correctly, I would also have to have a Theodolite instead of a transit."

**BASICALLY**, a Geodimeter is an extremely accurate distance-measuring instrument which uses a beam of light shot from the instrument to a distant reflector which bounces it back to a receiver in the instrument which automatically registers the distance. Corrections for temperature and pressure make its readings even more precise. No plodding crew, dragging a measuring "chain" is necessary, although lines of sight must sometimes be cut through wooded areas. Essentially it is quite similar to radar, employing light instead of radio waves.

So precise is this instrument that the ordinary surveyor's transit is not considered accurate enough to measure the angles involved. Hart's purchase of a much more costly Theodolite was thus necessary. Theodolites are used extensively in lining up and launching missiles at nearby Cape Kennedy.

**AS AN INDICATION** of the fantastic accuracy obtainable by the use of such "space age" instruments and methods, Hart's perimeter survey of the 12,450-acre tract required the accurate plotting of all of the property lines that make up the boundary. Because these lines seldom run in a straight line for more than a half-mile without making a right-angle turn to the right or left, the total distance of the boundary line from starting point, around the property, and back to the same point covered about twenty-eight and a half miles.

Surveys of acreage seldom "close" (return to the exact beginning point) with complete accuracy due to the human and mechanical errors to be found in measuring a line in rough terrain. These factors can cause a "closing error" of many feet or even yards in a survey of this size.

**TO THE AMAZEMENT** of Hart and other engineers in the area, however, the error of closure was found to be only 13 feet in one direction and 28 feet in the other — a total error of approximately two inches! This is ten times more precise than the finest work resulting from the best methods utilizing conventional equipment — transit and tape.

Finding it hard to believe such precise figures, Hart carefully rechecked all readings and computations, employing an IBM electronic computer in Ann Arbor, Michigan. Data was telegraphed to the computer center and acreage figures were returned the following day. Everything checked out correctly and the results were proven to be true.

"**WHILE** the geodimeter would be of little value in measuring a house lot," explains Hart, "its use in acreage surveys, over difficult terrain and across lakes, opens up a new era of accuracy never before obtainable." It serves a far cry from the original Government survey of Florida when a group of men or three hardy woodsmen, living off the land and using a magnetic compass with hand-straight "chain," staked out the original section corners in this area.

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*The Orlando Sentinel*
*July 4, 1965*

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Orlando Sentinel
Real Estate-Financial
Land Sales... Building News
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SECTION B
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# 'Space Age' Devices Set Surveying Record

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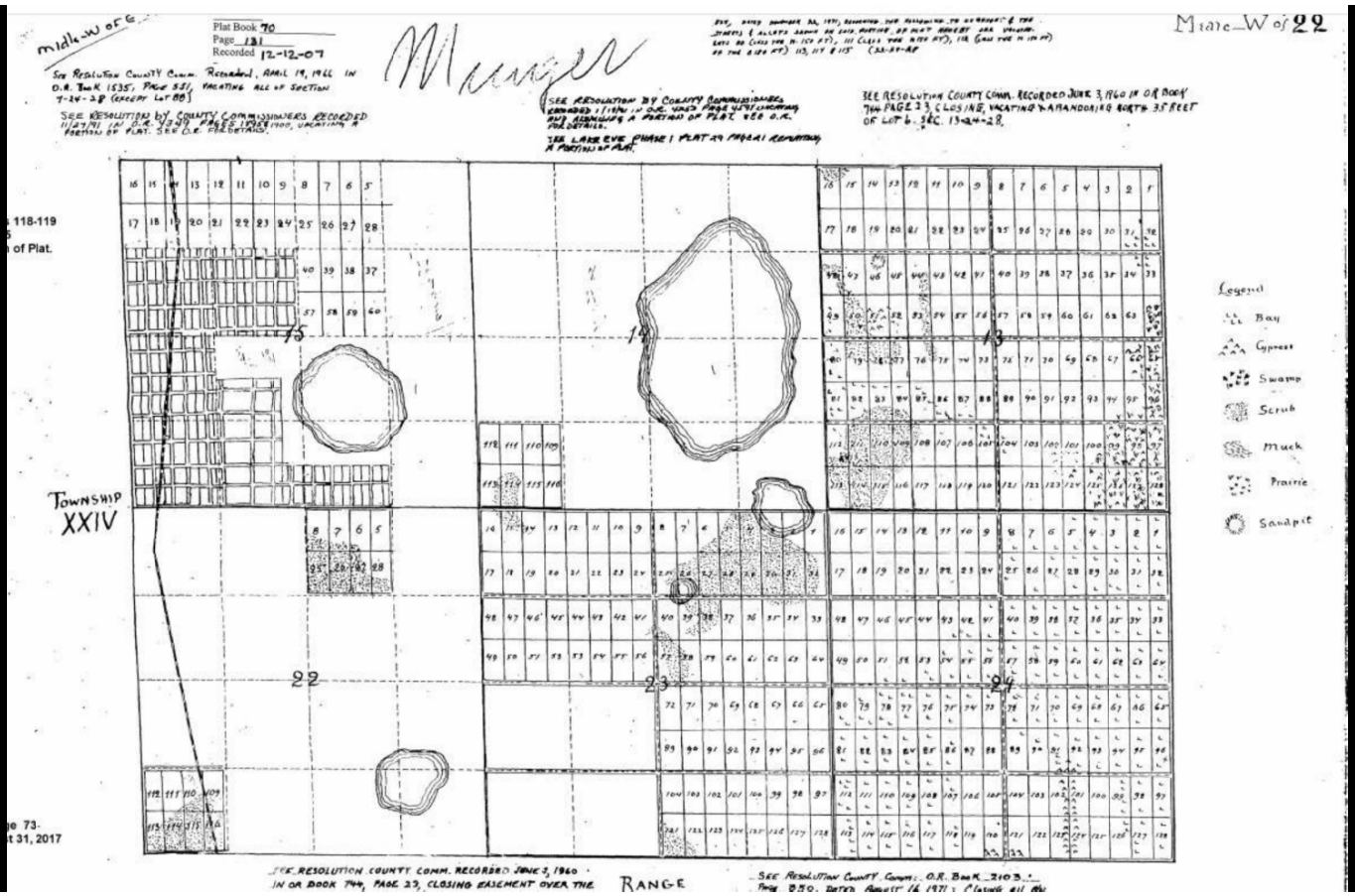



# The Price and Location of

# THE MUNGER FARMS

## Make them Ideal Homes or Investments.

Have you selected yours? If not use the following Application:

MONTHLY PAYMENT APPLICATION.

WILLIS R. MUNGER, 517 Francis St., St. Joseph, Mo.

Dear Sir: Find enclosed $.....as first payment by me on a..... acre Munger Farm in Orange County, Florida. I agree to make further monthly payments, as per your schedule, until my farm has been paid for. The price is to be $20 per acre, without interest or extra charges of any kind, and you will guarantee title and pay all taxes until I have completed my payments.

In making remittances, please follow the schedule given here:

$ 5.00 cash and $ 5.00 per month buys a five-acre farm.
10.00 cash and 7.00 per month buys a ten-acre farm.
20.00 cash and 10.00 per month buys a twenty-acre farm.
40.00 cash and 20.00 per month buys a forty-acre farm.

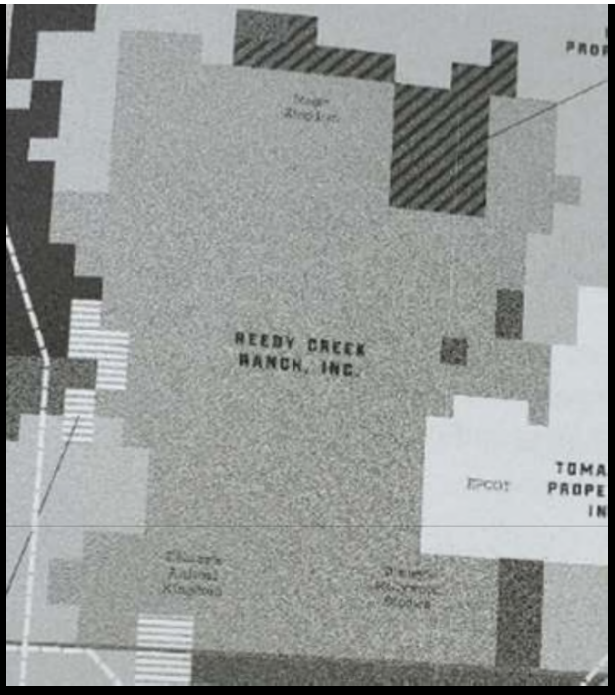
You are given immediate possession without signing further agreements as soon as you have made a single payment on your farm.

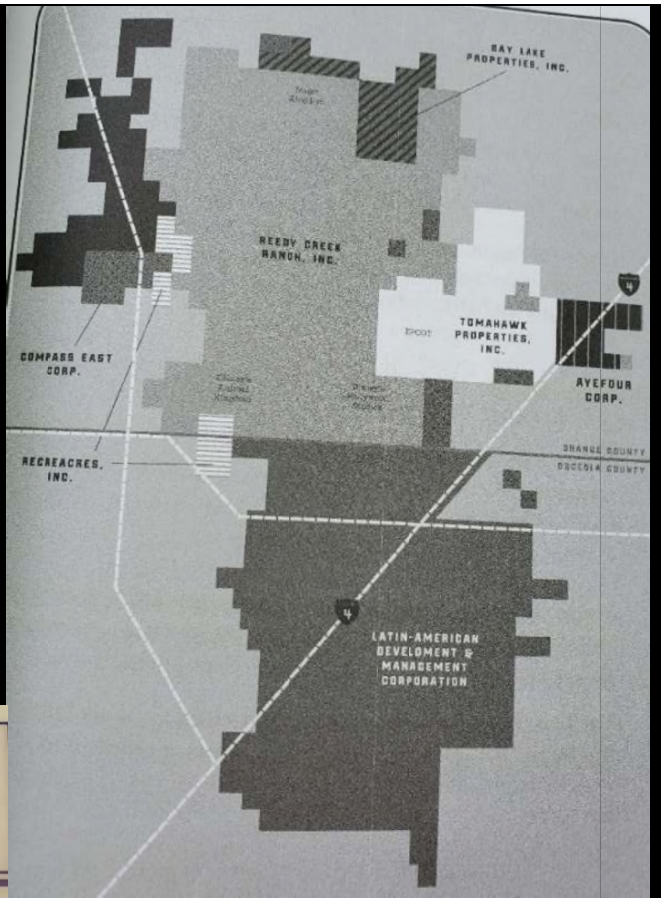
Name... ... ... ... ... ... ... ... ... ... ... ... ... ...

Address... ... ... ... ... ... ... ... ... ... ... ... ... ...

Or call on LEN J. MUNGER, the Orlando Representative,
Office With C. S. McEwen, 3 Doors South of Postoffice.

Demetree Parcel




CERTIFIED CORRECT

Wm C Hart

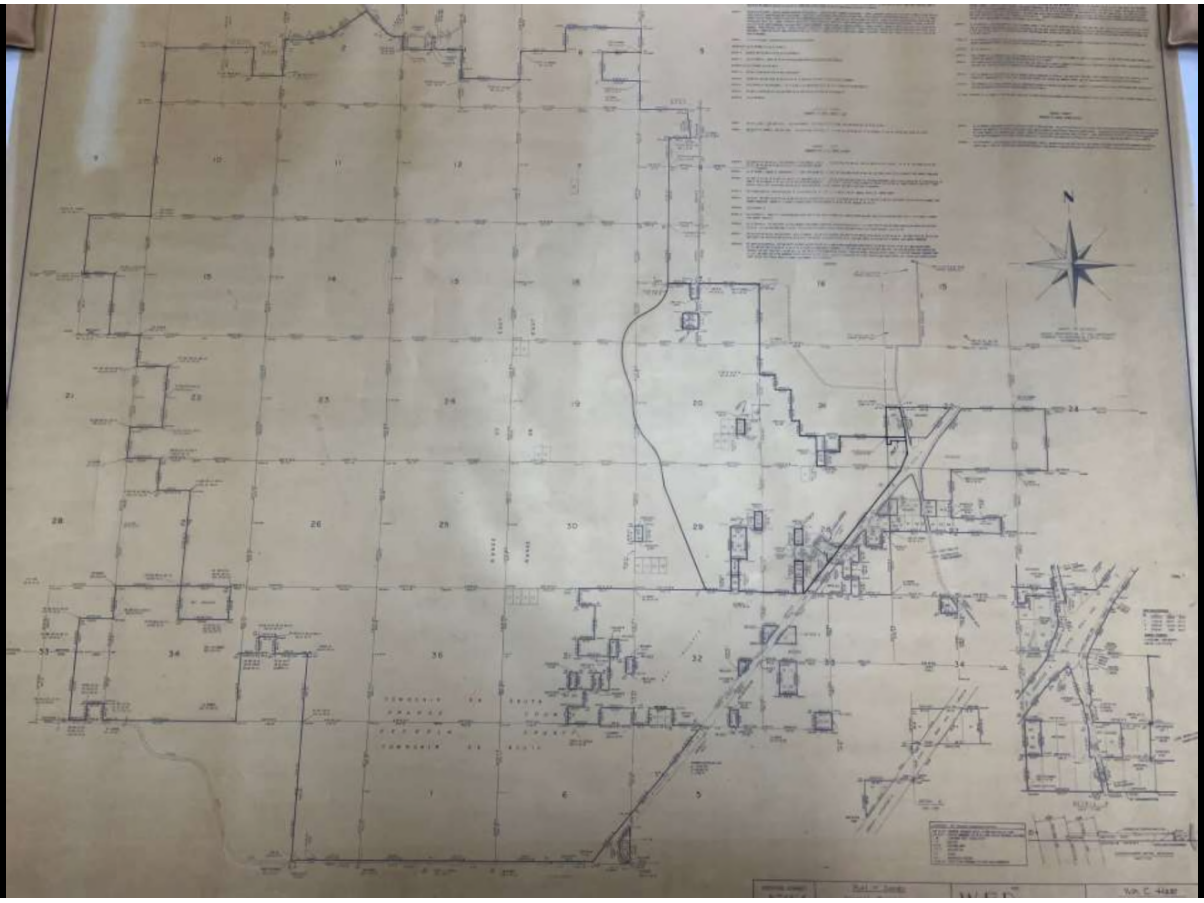
FLA. REG. NO. 890

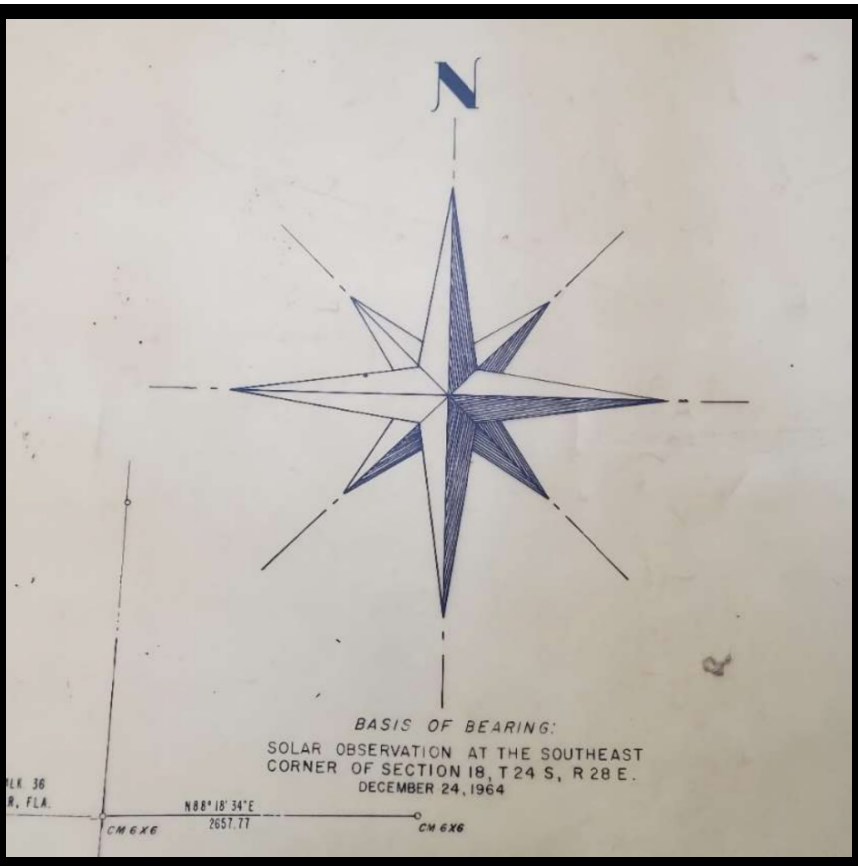
# PLAT OF SURVEY

## COMPASS EAST LANDS

NORTH OF STATE ROAD 530

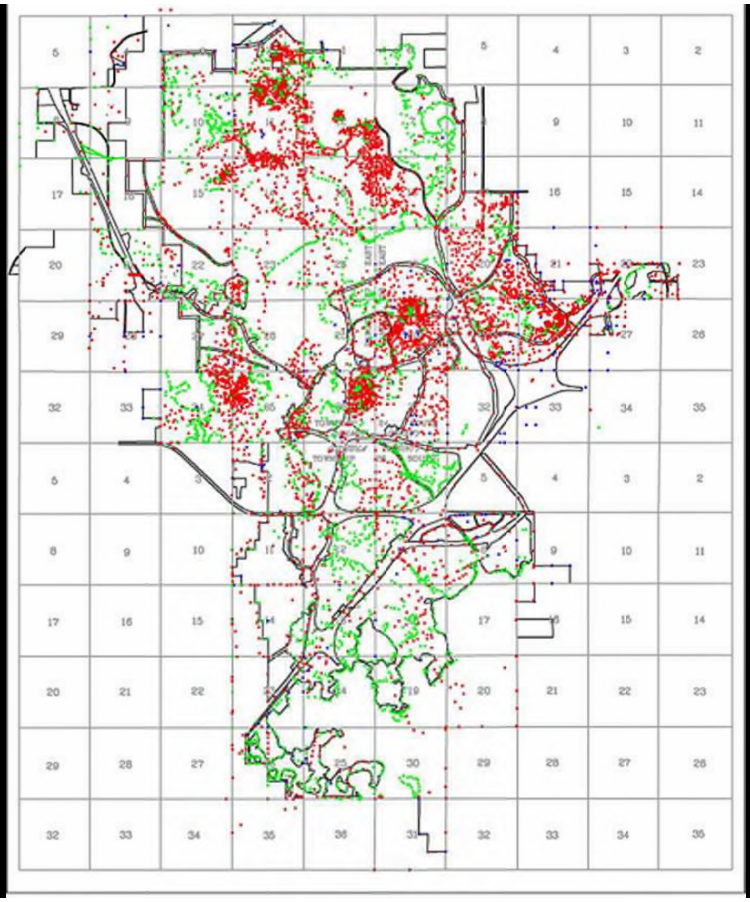
LYING IN ORANGE AND OSCEOLA COUNTIES —— FLORIDA






BASIS OF BEARING:
SOLAR OBSERVATION AT THE SOUTHEAST
CORNER OF SECTION 18, T 24 S, R 28 E.
DECEMBER 24, 1964

Walt Disney World Control Network




Walt Disney, General William “Joe” Potter, Roy Disney
November 15, 1965 – Cherry Plaza Hotel, *Florida Archives*

Bill Hart, Walt Disney, General Potter, Roy Disney, Card Walker, Admiral Fowler

Magic Kingdom early construction (looking South-Seven Seas Lagoon at the top)



November 1964
Begin Survey Demetree Tract 12, 450 Acres

December 24, 1964
Solar Observation

May 1965
Bronson Tract 8,380 Acres
Bay Lake Properties 1,250 Acres
Hamrick Tract 2,650 Acres

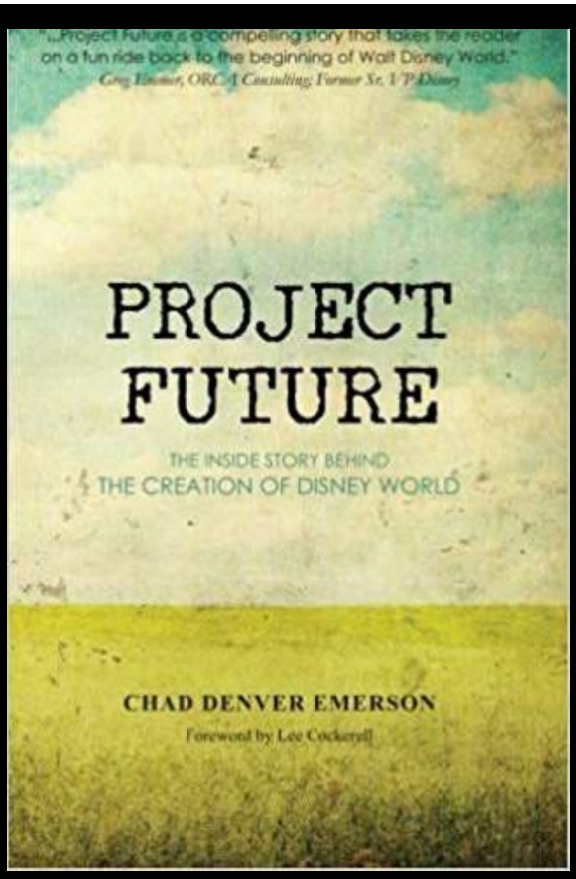
July 4, 1965
Orlando Sentinel Article

October 1965 Land Clearing begins

November 15, 1965
Formal Announcement

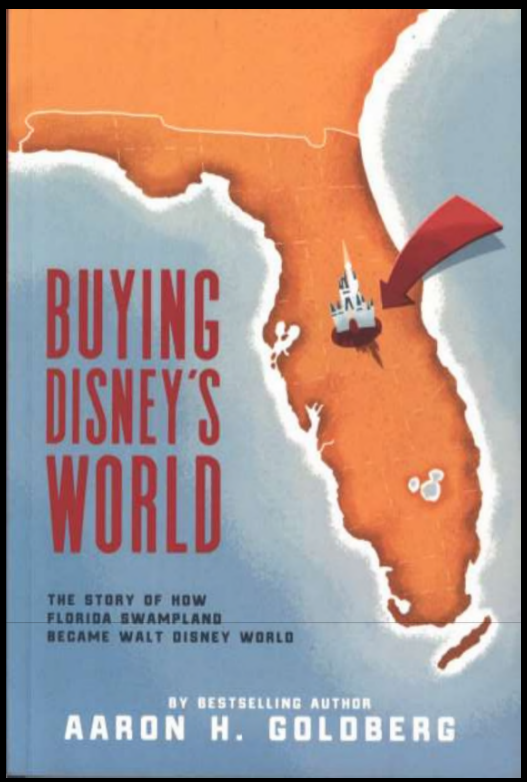
October 1, 1971
Magic Kingdom opens to the public

# Development Timeline




- The Walt Disney World Resort near Orlando, Florida is one of the world's most famous vacation destinations. This iconic resort is now located in what once was thousands of acres of swamp and marshland. Through spy-like moves and innovative strategies, Walt Disney and his cadre of creative leaders turned this massive swamp land into today's Disney World. This books shares the amazing behind the scenes story of how Disney's Florida resort, code-named Project Future, rose from the marshes of Central Florida to become one of the world's most popular theme park resorts.
- *Project Future*

- *As told through the personal notes and files from the key figures involved in the project….*
- *Buying Disney's World*



# Additional Resources

- University of Central Florida, Robert Foster/RCID Collection
- Florida Archives (FloridaMemory.com)
- D23.com
- *Married to the Mouse, Walt Disney World and Orlando*, Richard E. Foglesong

附件 2

# Dr Diane Dumashie, FRICS
# FIG President

## Serving Society;
## Benefitting People and the Planet

*Tackling the Global Challenges*

Opening Ceremony
FIG Working Week, Orlando, USA
29th May 2023



# Overview

1. What

2. How we navigate

3. Pillars

4. Final Word

# What

**….. Step up to remain relevant**

Vision:

- **Serving Society, benefitting people and the planet**

Theme:

- **Tackling the Global Challenges** (Trends and crisis)

- How? Ambitious plan:

  to Shape and to Action…..



# How: The Future We want to shape


**FIG 2030 Sustainability Agenda**

Drawing from UN Habitat 5P Agenda this:

- Sustainability cuts across all that we do
- Provides a framework to guide our work plan

Our Vision to 'serve' supports,

"Leaving no one behind"

Articulates our Theme:

Tackling the Global Challenges

# How- Aims and Pillars


**Work Plan :**

- **People**
- **Planet**
- **Partnership**
- **Governance & Communication**

•Task Forces reflect the aims, and

•Are our Pillars to provide focussed thought leadership to articulate our Relevance & Societal benefit



# Final Remarks

FIG Orlando Working Week 2023

# Thank You

- WWW.fig.net

- President
- FIG: Dr D Dumashie
- ddd@dumashie.co.uk

# The Disaster Management of Large Scale Landslide: A Case Study of Debris Flow Early Responding Systems

**Tien-Yin CHOU**, **Chen-Yang LEE**, **Hsiao-Yuan YIN**, **Yi-Chia LIN**, **Mei-Ling YEH**
**Taiwan**

**Key words**: large scale landslide early responding systems; debris flow; large scale landslide

**SUMMARY**

This paper studies the mechanisms of large-scale landslide management. It established early responding feedback mechanisms for the application in different scenarios. The paper started with the site descriptions of debris flow and large-scale landslides. It stated the fundamental differences between two types of disaster and followed by discussions of the uniqueness and necessity of large-scale landslide early responding mechanism establishment. With the current debris flow early responding systems as the evidence, this study clarified various important aspects in the early responding system. It includes the parameters of alerting area, monitoring equipment, data values, procedures of disaster prevention and evacuation. The clarifications can further shapes the workflows of large-scale landslide early responding system.

Meanwhile, this paper studies references for the large-scale landslide responding parameters of specified monitoring rain gauge and on-site monitoring devices. A series of simulations have been carried out to discover the disaster factors and its data collection methods. Knowledge obtained was then contributed to the real-time data analysis development. Subsequently, disaster discussion-making center can generate alerting parameters, calculation formulas and associated responding signals (red or amber) according to its associated environmental factors. At the end of the study, the mechanisms of issuing and disarming alert system, as well as the principles of issuing alert system have been discussed.

## 1. INTRODUCTION

The impact of global climate change has caused frequent occurrences of natural disasters in many countries and serious losses in personnel and the economy. It is suggested that if a disaster early-warning mechanism can be established, people may conduct disaster reduction and prevention work in advance before disasters appear, thus effectively reduce losses. However, at present, there is no unified warning publishing standard for different types of disasters in terms of the early-warning mechanism. When different disasters occur, it is easy to cause confusion among the public with different warning publishing standards, thus leading to a cost increase in disaster management.

Therefore, with the disaster early-warning mechanism for debris flows and large-scale landslides established by the Soil and Water Conservation Bureau (SWCB), this study will explore the applicability of yellow and red warning publishing rules to other disasters in the disaster early-warning mechanism, so as to further put forward the feasibility of standardization of yellow and red warning publishing rules.

## 2. MATERIALS AND METHODS

This paper studied the warning-issuing mechanisms at particular study sites. When the Central Weather Bureau issues typhoon warning or torrential rain warning, Debris Flow Disaster Prevention Center and Large-Scale Landslide Disaster Prevention Center would be initiated by SWCB. It provides monitoring data for the Debris Flow Disaster Prevention Information Platform. This study discussed the types of warning, their relevant descriptions and issuing mechanisms (Segoni, 2018). This paper also reviewed the warning-issuing procedures of debris flow and large scale landslide, applications of monitoring sensors and the basis to issue and disarm alerts (Zhang, 2020). The measurements under warning alerts, issuing principles, units and standards of warnings are the highlights of the mechanisms (Baum, Godt, 2010). This paper also explored the procedures of issuing warnings, monitoring data obtained and purposes of data distribution.

In order to enhance the accuracy of debris flow early responding system and reduce the impact by debris flow disaster, SWCB proposed the updates of reference values and operation instructions for debris flow early responding system. It based on the results from debris flow demonstration sites and adjusting the data constantly. The flow chart of debris flow reference value update mechanism as Figure 1 is shown as below.

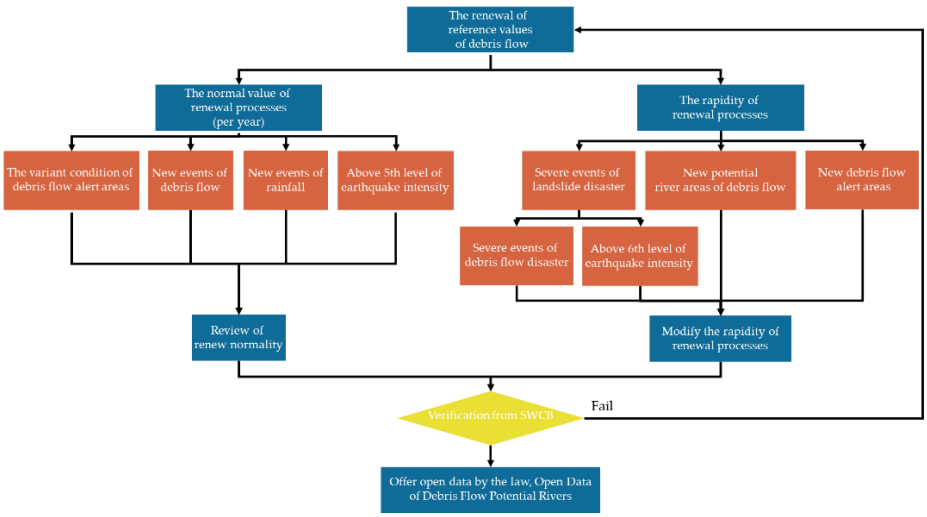



**Figure 1.** The flow chart of debris flow reference value update mechanism

## 3. THE FRAMEWORK FOR THE PUBLISHING PRINCIPLE OF WARNING

According to the types of disasters, the publishing principle of yellow and red warnings is to discuss the disaster occurrence factors and necessary conditions. Based on the occurrence factors and necessary conditions, corresponding on-site monitoring instruments should be set up accordingly to collect on-site monitoring data for recognizing the environmental characteristics in this area. Afterwards, an evaluation and analysis can be conducted based on the disaster occurrence factors and on-site environmental characteristics to serve as the warning reference value for possible disasters.

The warning reference value is served as the basis of the warning publishing principle. According to the types of disasters, the disaster occurrence speed and response time may be evaluated to establish various levels of warning classification, such as yellow warning symbolizing high warning and red warning symbolizing immediate danger. Based on the publishing principle of yellow and red warnings, corresponding contingency actions and disaster prevention measures may be taken.

For various levels of warning classification and contingency actions recommended, relevant instructions are yellow warning and red warning. When the warning reference value may be reached in the future based on the environmental information monitored in advance, indicating doubtful risk of dis-aster occurrence, a yellow warning will be published to advise local inhabitants to pay high attention and take corresponding disaster prevention measures according to various types of disasters. When the data monitored by on-site monitoring instruments have reached the warning reference value, indicating the risk of immediate disaster, a red warning will be published to force local inhabitants to take immediate disaster prevention measures according to various types of disasters.

## 4. THE APPLICATION OF THE PUBLISHING PRINCIPLE OF THE YELLOW AND RED WARNING

SWCB established the disaster early-warning mechanism for debris flows in 2004 and initially applied the publishing principle of the yellow and red warnings to the disaster early-warning mechanism. Moreover, it established the disaster early-warning mechanism for a large-scale landslide in 2021. In order to integrate various types of disasters, the publishing principle of the yellow and red warning is applied to facilitate the operation of disaster management. Below, the disaster early-warning mechanism for debris flows and large-scale landslides will be specified separately to illustrate the application method for the yellow and red warning principle.

### 4.1. Debris flows and disaster early-warning mechanism

It has been many years since SWCB established the disaster early-warning mechanism for debris flows. With abundant experiences in disaster prevention, this early-warning mechanism had already published warning messages many times before disasters occurred, successfully avoiding or reducing the losses caused by disasters. This study will explain below the application of the disaster early-warning mechanism for debris flows in terms of the characteristics of debris flows, as well as the publishing of yellow and red warnings.

As investigated by SWCB on the potential stream of debris flows every year. As of January 2023, 1, 731 potential streams of debris flow and their influence scope have been circled and drawn out at present. SWCB has taken rainfall as the reference basis of the warning reference value in these areas and set up the warning reference value and adjustment mechanism for debris flows. Next, SWCB has drawn up two levels of yellow warning and red warning to establish various levels of the disaster early-warning mechanism for debris flows. The warning levels are specified as follows, and the process is shown in Figure 2.

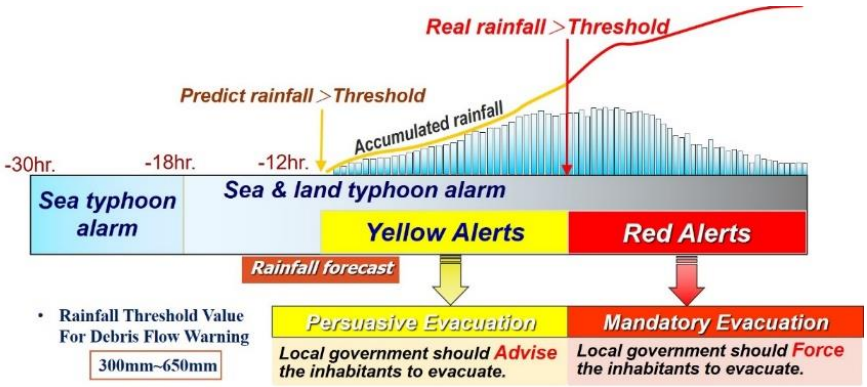



**Figure** 2. The flow chart of rainfall-based Debris Flow Warning Model

Yellow warning: When Central Weather Bureau publishes typhoon warnings or special reports of heavy rain, the effective rainfall accumulated in each region will be estimated. When this rainfall may reach the warning value of debris flows in this region, a yellow warning will be published to advise local inhabitants to evacuate and take refuge prophylactically.

Red warning: However, when the actual effective rainfall accumulated reaches the warning value of debris flows in this region, the warning level will be updated to be a red warning, so as to force local inhabitants to evacuate for resettlement.

### 4.2. Warning publishing process

The yellow and red warning publishing rules of the disaster early-warning mechanism for debris flows established by SWCB have been in operation for many years with rich practical operation experience. They have also been applied to the disaster early-warning mechanism for

large-scale landslide. Therefore, this study proposes to standardize the yellow and red warning publishing rules and set up warning publishing standards that can be applied to the early-warning mechanism for various disasters. This study suggests to study and draw out a standard process of the disaster early-warning mechanism with commonality as shown in Figure 3. The data collection information includes monitoring data and image data of on-site sensors, and relevant early-warning information is published through early-warning models of various disasters.

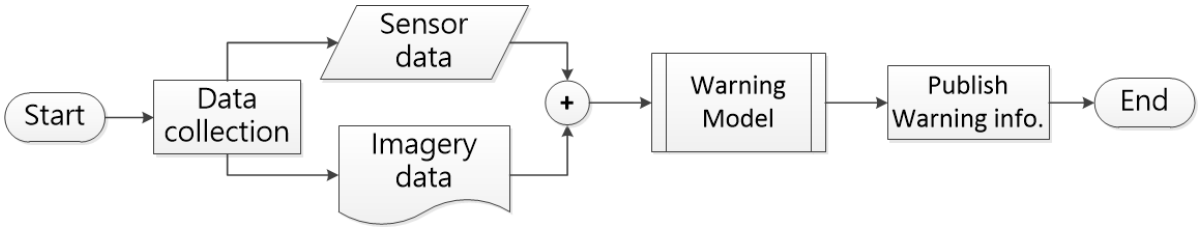



**Figure 3.** Standard Process of the Disaster Early-warning Mechanism

## 5. RESULTS AND DISCUSSION

This study aimed at the establishment of large-scale landslide early responding system. With the foundation of current debris flow early responding system, it is expected to build a relevant system for the large-scale landslide. When extreme weather approaches, it is designed to trigger the reference value, prepare and manage the situation before disasters happen. Due to the natural difference between large scale landslide and debris flow, the study seeks for the suitable on-site equipment to assist the rain gauges as the evidence for reference values. Through the setup of reference values, the work flow of large scale landslide early responding system can be completed. Currently, SWCB distinguished debris flow and large-scale landslide as two different forms of disaster. They broadcast different warning information for different disaster management purposes.

## 6. CONCLUSIONS

Key objective of the study is to develop the management mechanisms of large-scale landslide. The development based on current workflow of debris flow early responding systems, types of monitoring equipment required and their reference values. In present, there is no accurate formula to transform the data of on-site equipment to the reference values of alerting system. Monitoring data still require manual judgement to decide if it reaches the alerting standard. Therefore, the principal of issuing alert is still relied on participation level. It is wished to develop a reliable formula for on-site equipment data transformation, and the early responding system can be applied in different weather scenarios.

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## BIOGRAPHICAL NOTES


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FIG WORKING WEEK 2023
28 May - 1 June 2023 Orlando Florida USA
Protecting Our World, Conquering New Frontiers

# The Disaster Management of Large Scale Landslide:

## A Case Study of Debris Flow Early Responding Systems

Tien-Yin Chou
Director / Lifetime Distinguished Professor
GIS Research Center, Feng Chia University, Taiwan

Chen-Yang Lee
Director General, Soil and Water Conservation Bureau, Council of Agriculture, Taiwan

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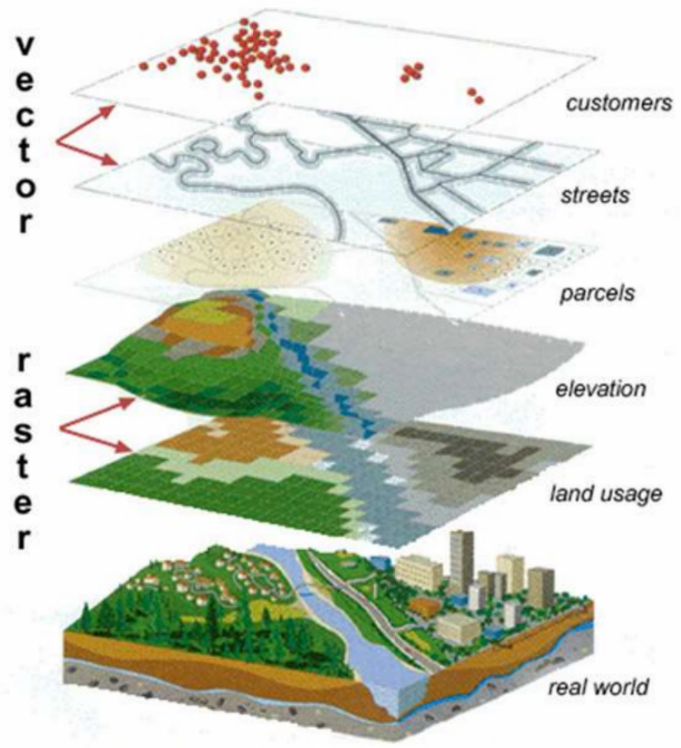
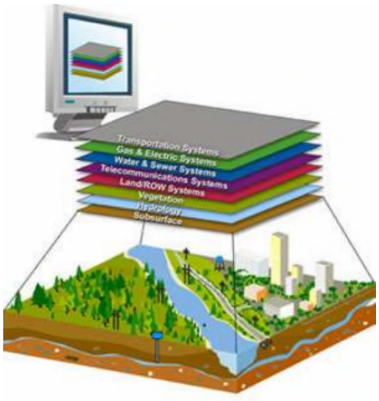
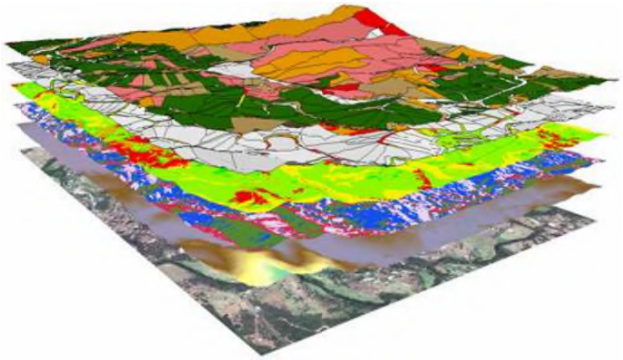
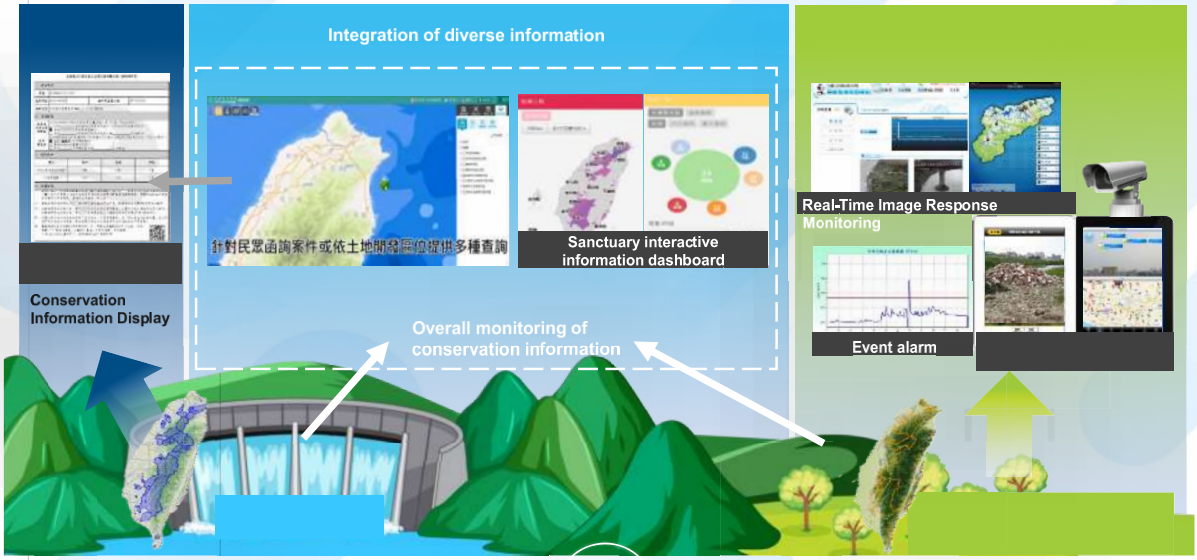
Real World – Complex Information...



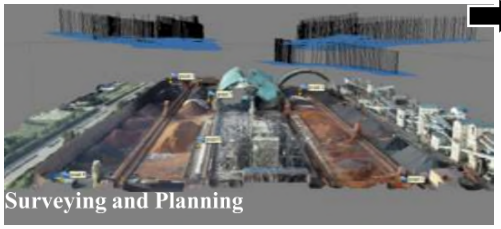
## Sustainable Environment Monitoring and Management

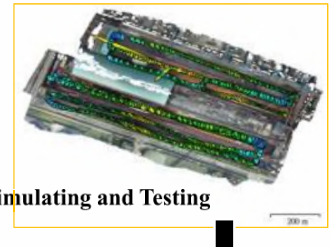


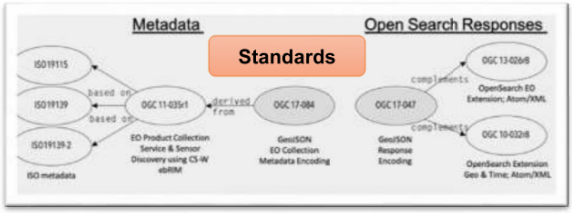


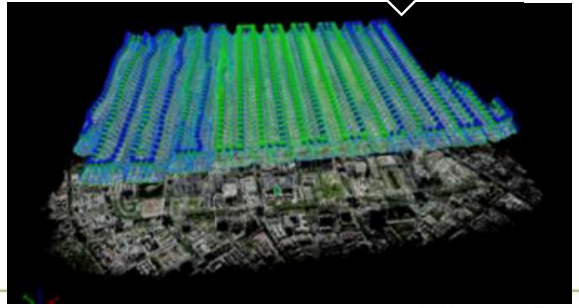



# National Geospatial Strategy and Digital Twin Application



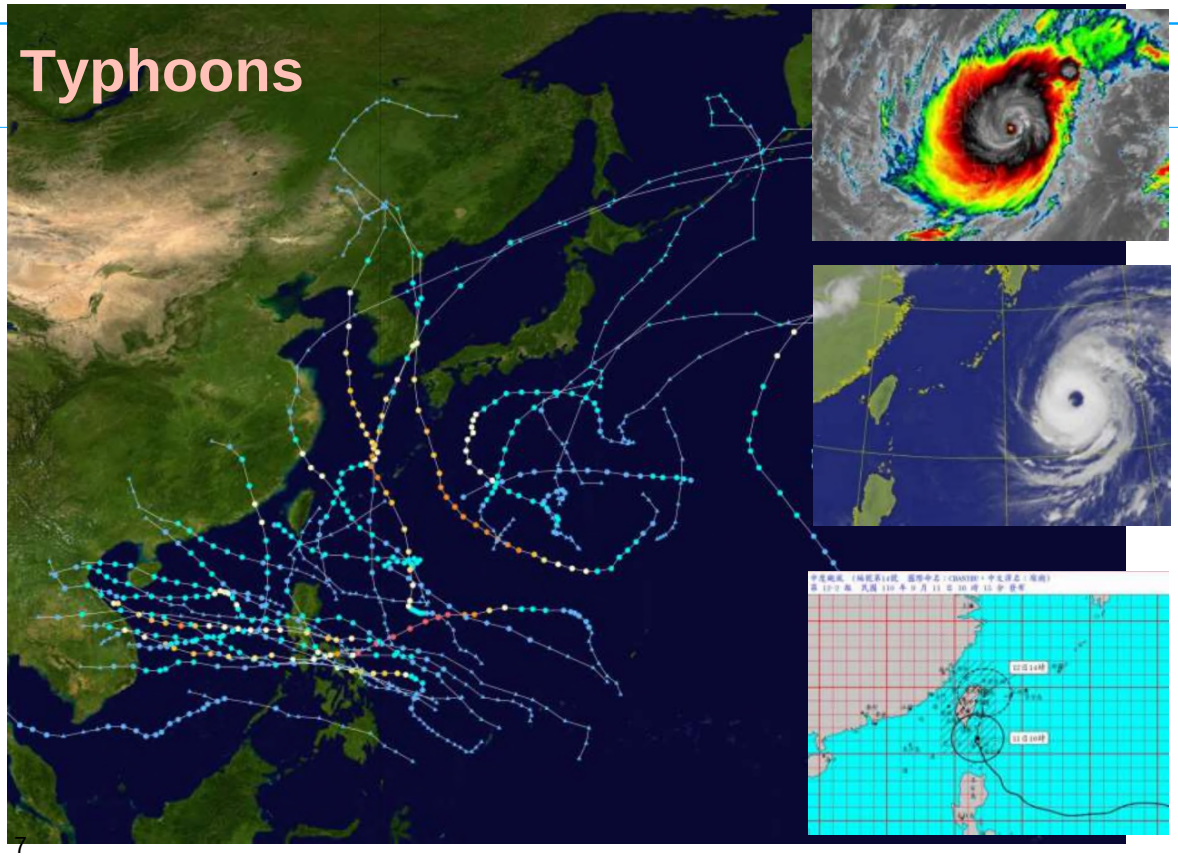



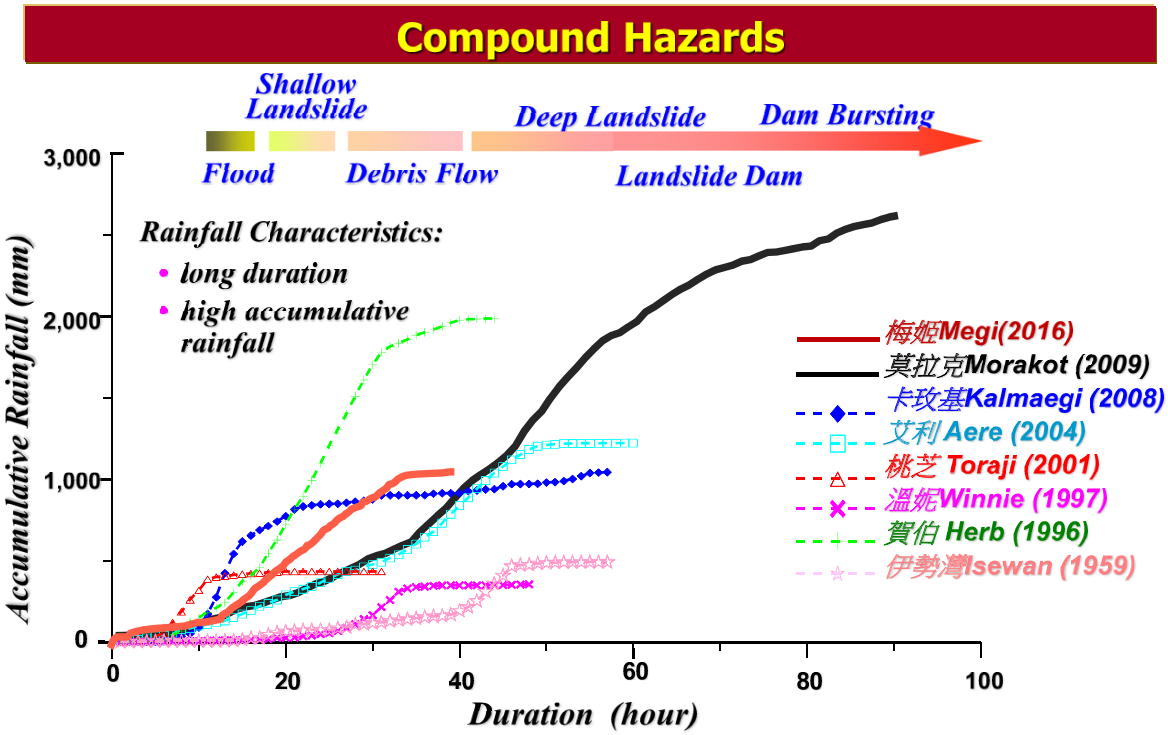



Path planning → Build navi-points → Convert points to GeoJson

## Multi-Scale & Multi-Dimensional

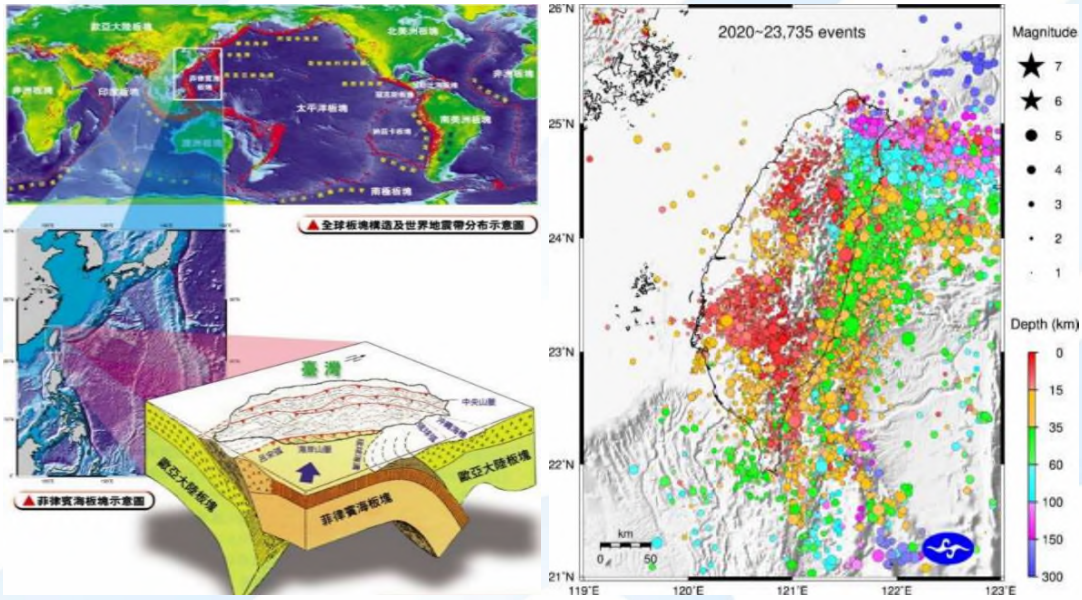


# Rainfall-Duration Curve of Typhoons



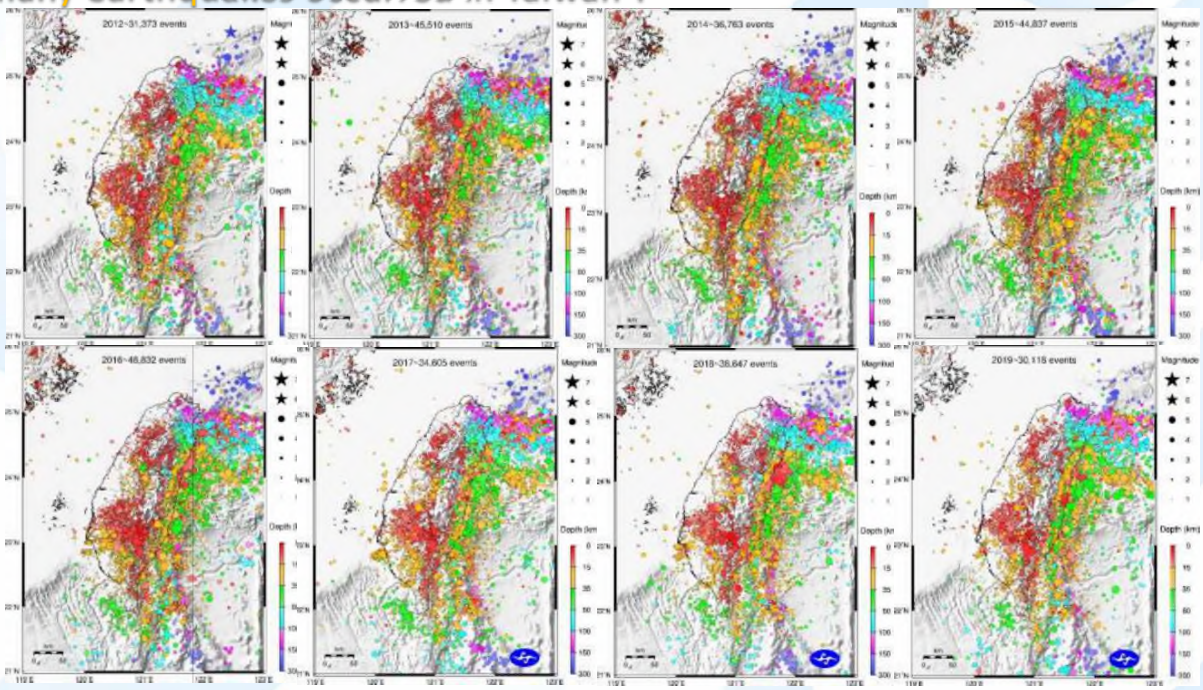

# Seismicity in Taiwan

## Tectonic plates and faults

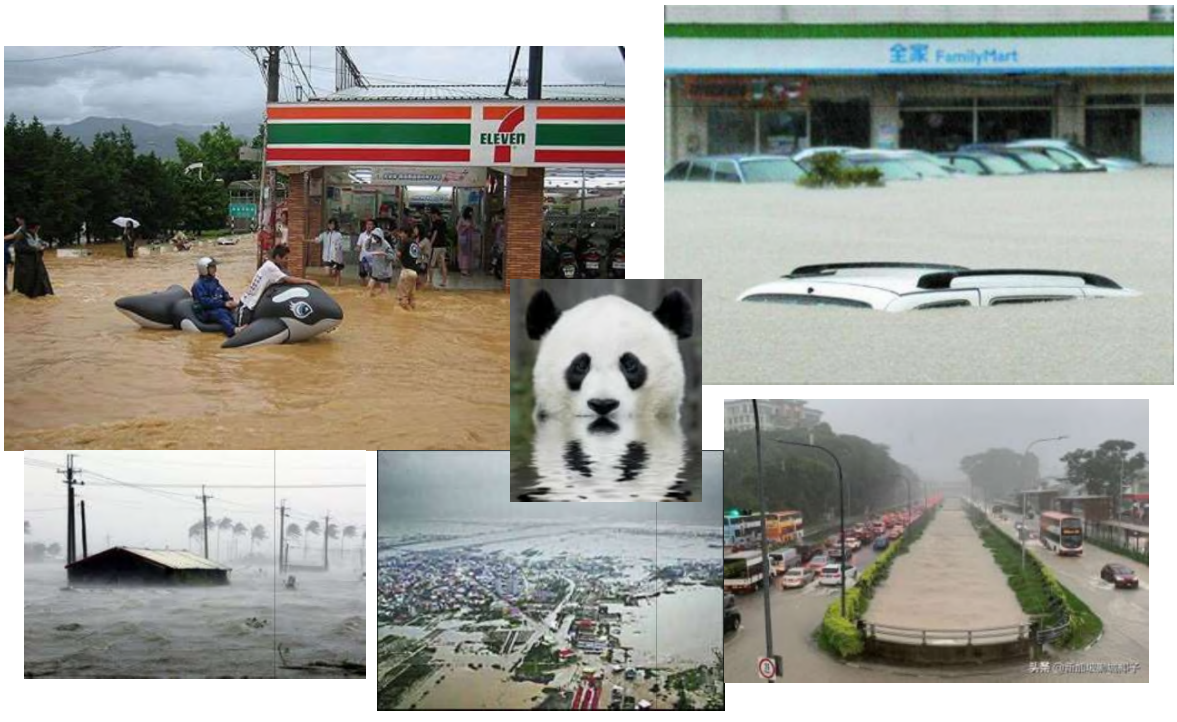


# Seismicity in Taiwan

## How many earthquakes occurred in Taiwan ?



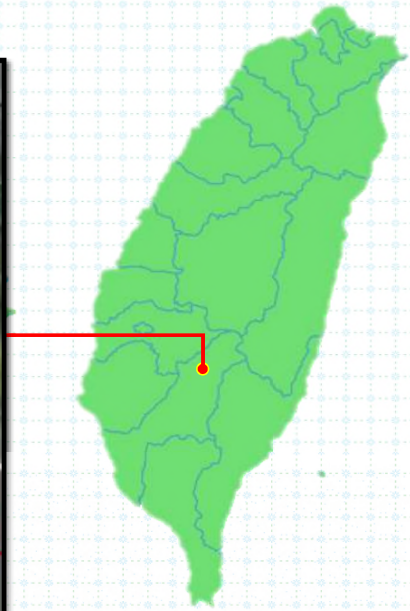


# Landslide and Debris Flow Disasters in Taiwan

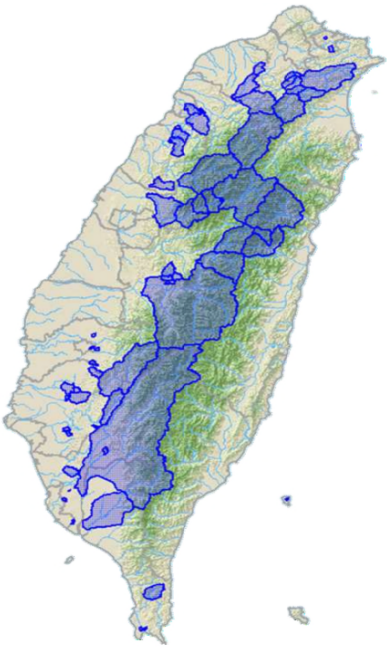






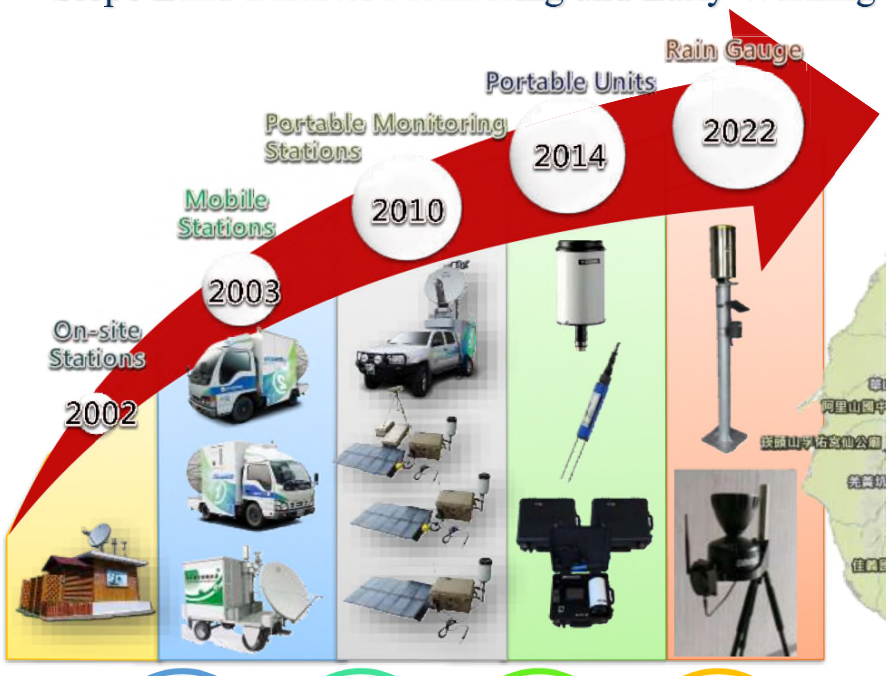
影片來源：公視/我們的島

# What we've concerned



- Environmental monitoring
  - Most area in Taiwan is fragile and sensitive.
  - Various equipment used to detect and monitor all kinds of environmental characteristics

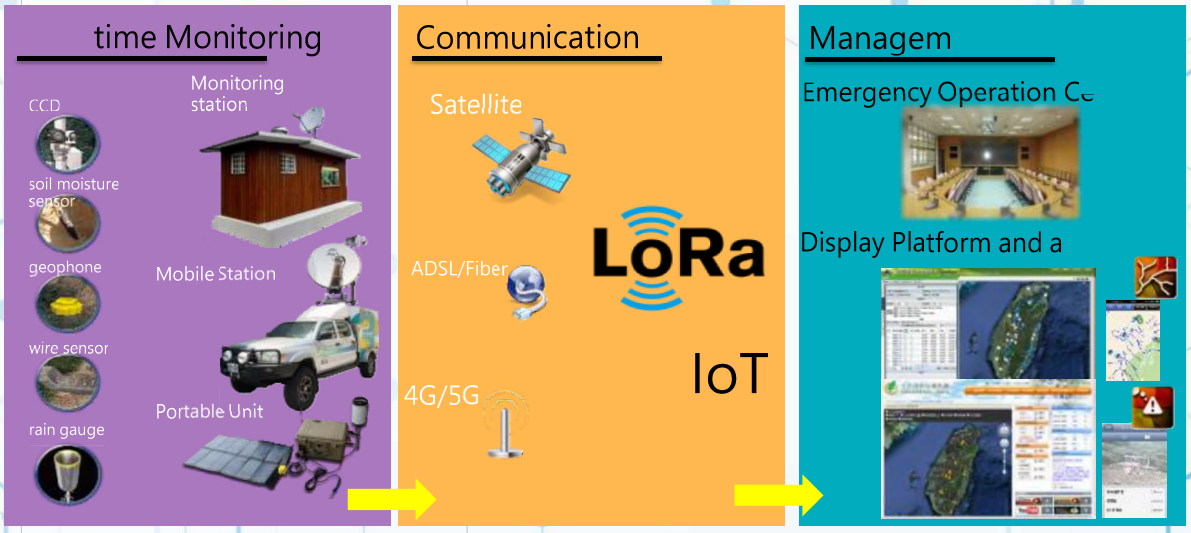
## Slope Land Disaster Monitoring and Early Warning





Sta. x24 → Mobile Sta. x 4 → Portable Unit x17 → Rain. Sta.

# Slope Land Disaster Monitoring Systems in Taiwan



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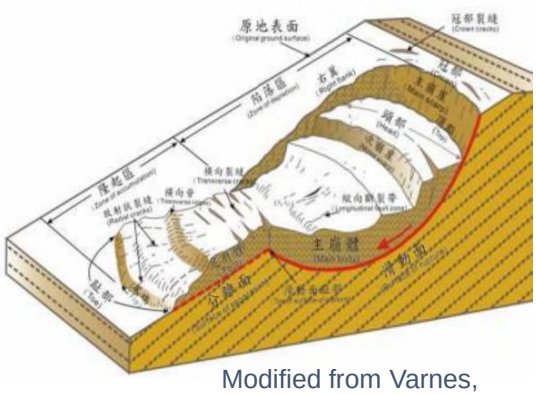
## *Identification of Potential Areas Prone to Large Scale Landslide*

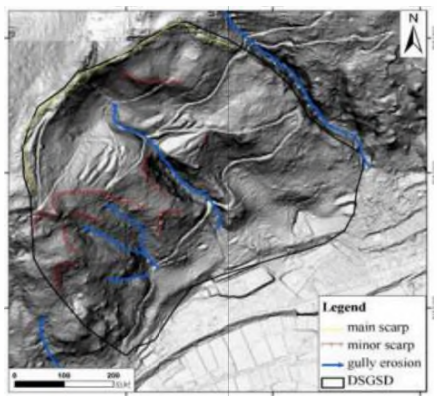
- **9,848 potential areas are located by CGS, Forestry Bureau, and SWBC using *Airborne Lidar Techniques*.**
- **34 priorities are chosen for special treatments including on-site monitoring and engineering.**

### Light Detection & Ranging (LiDAR)

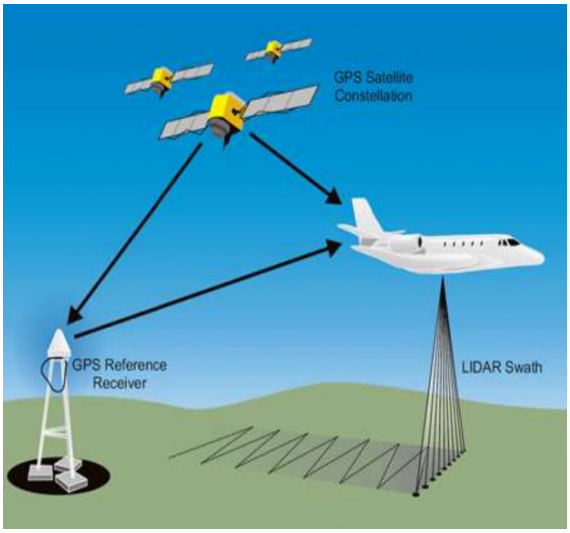
**Lidar is commonly used to produce high-resolution DEM (digital elevation model)**



Modified from Varnes, 1978




1-m DEM




http://www.arcland.eu/capture/lidar/1514-airborne-lidar-technology

## *Large-scale Landslide Hazard Mitigation Program*

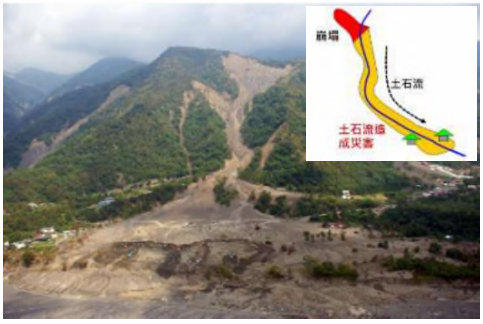
***Definition: Area 10 ha; Depth 10 meters ; Volume 100,000 m3***

***1st Stage : 2017-2020(4 years), --34 sites***
***2nd Stage : 2021-2026(6 years), --64 sites*** ***Target : 98 potential sites***

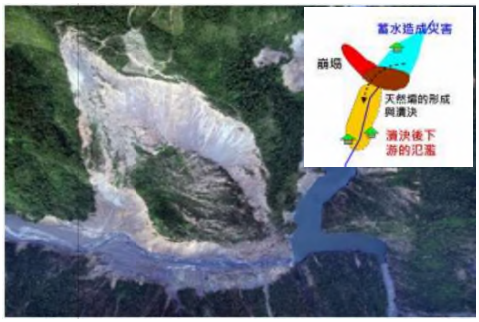
****The event, Large scale landslide, has been contained in the law "Disaster Prevention and Response Act" in 2022 after debris flow in 2000.***

Large-scale Landslide types

By gravity



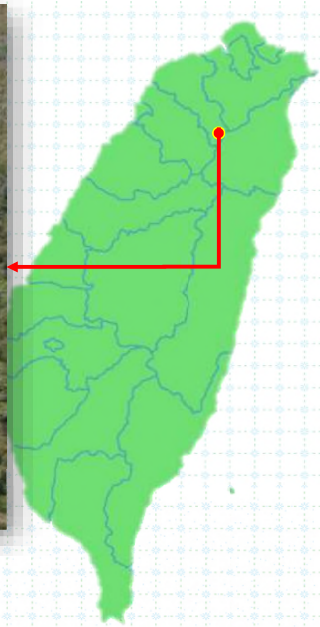
By debris flow



By barrier lake

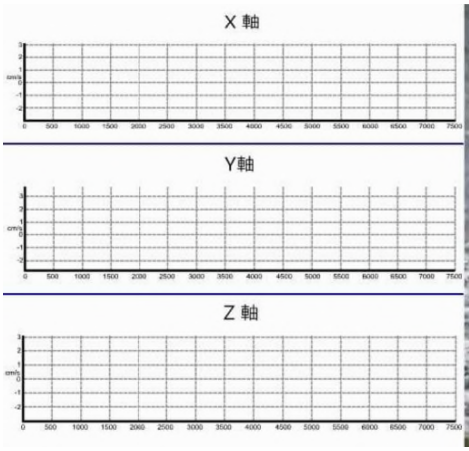
## Large-Scale Landslide Disaster



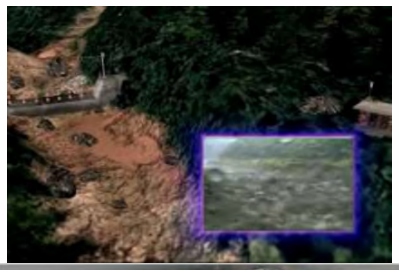


- **Long-term slope sliding from 2002**
- Displacement expanded from 2021 Jan.
- **Potential landslide volume 92,000m$^3$**

影片來源：youtube/華視新聞雜誌







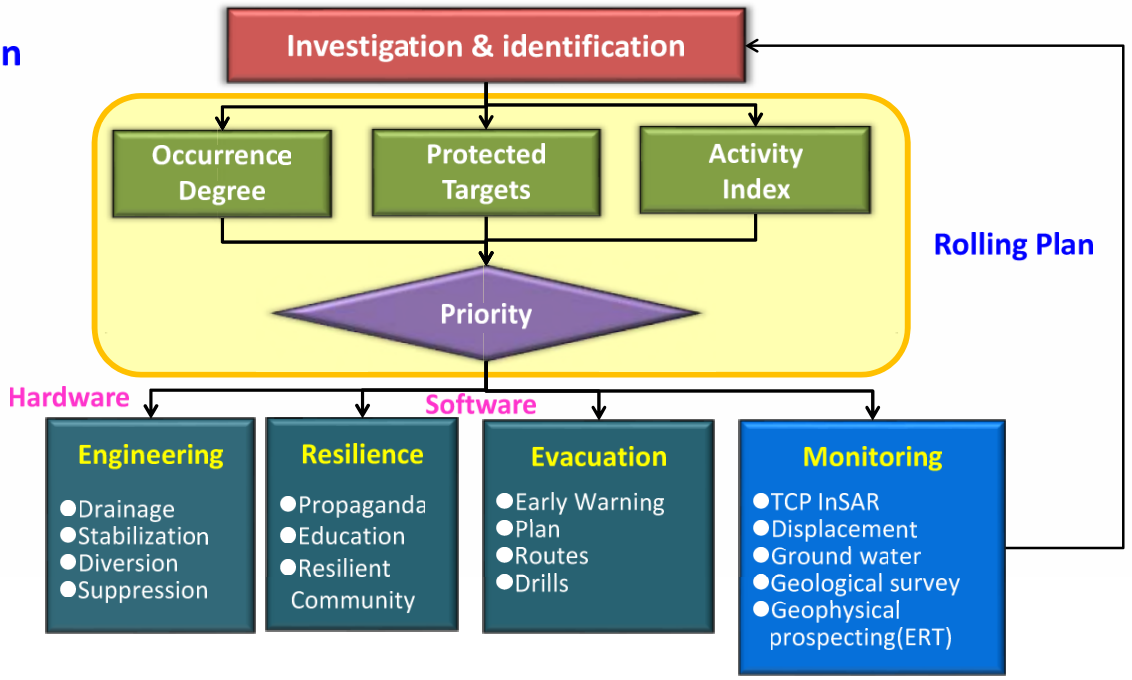



# *Framework of Large Scale Landslide Hazard Mitigation*

**Risk Identification**

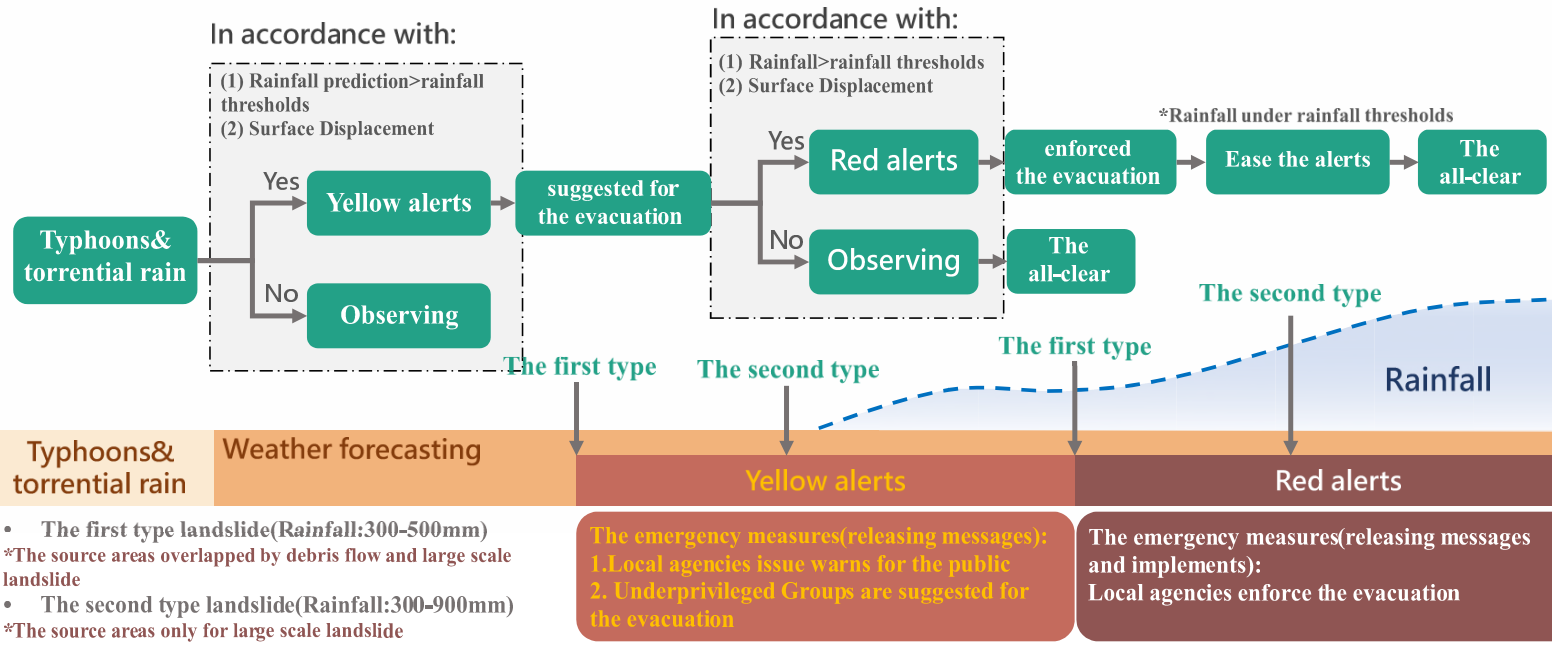
**Risk Analysis**

**Risk Disposal**



# The procedure of early responding systems

## The first type landslide & The second type landslide




- The first type landslide(Rainfall:300-500mm)

*The source areas overlapped by debris flow and large scale landslide

- The second type landslide(Rainfall:300-900mm)

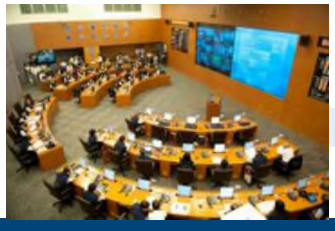
*The source areas only for large scale landslide

The emergency measures(releasing messages):
1.Local agencies issue warns for the public
2. Underprivileged Groups are suggested for the evacuation

The emergency measures(releasing messages and implements):
Local agencies enforce the evacuation

# Slope land Disaster Monitoring Technology for Decision-Making


Satellite
Fiber optic
Microwave
5G/4G
LoRa
NB-IoT



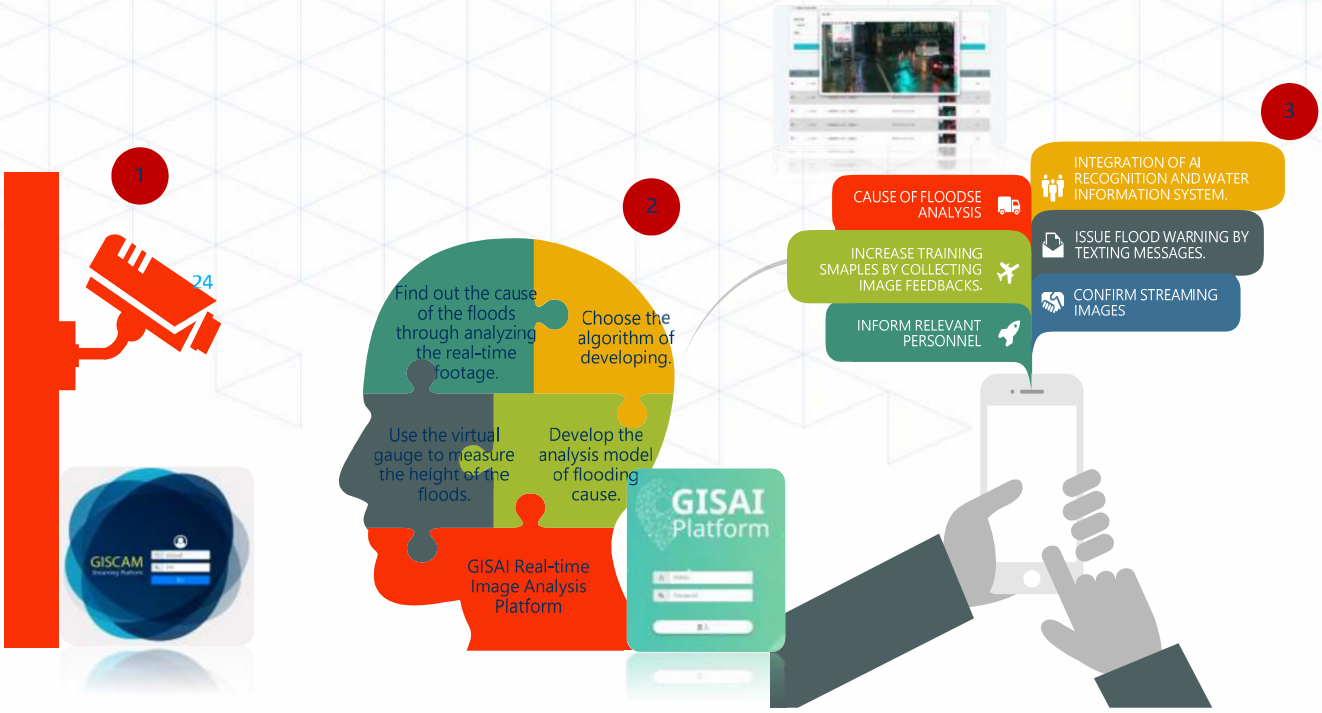
Emergency Operation Center

Alert


Monitoring website / Smart stations

warnings

# Images analysis process






*AI Technologies*

## Deep Learning Ecosystem

| | | |
|---|---|---|
| Application | AI, Classification, etc | Domain Experts, Production/Solution |
| Framework | *Caffe, TensorFlow*, etc | Open Source Applying, Implementation |
| Library Language | *cuDNN, OpenCL*, etc | Model Developing, Academic Research |
| Hardware | GPU, CPU | Cooperate with National High Performance Center |

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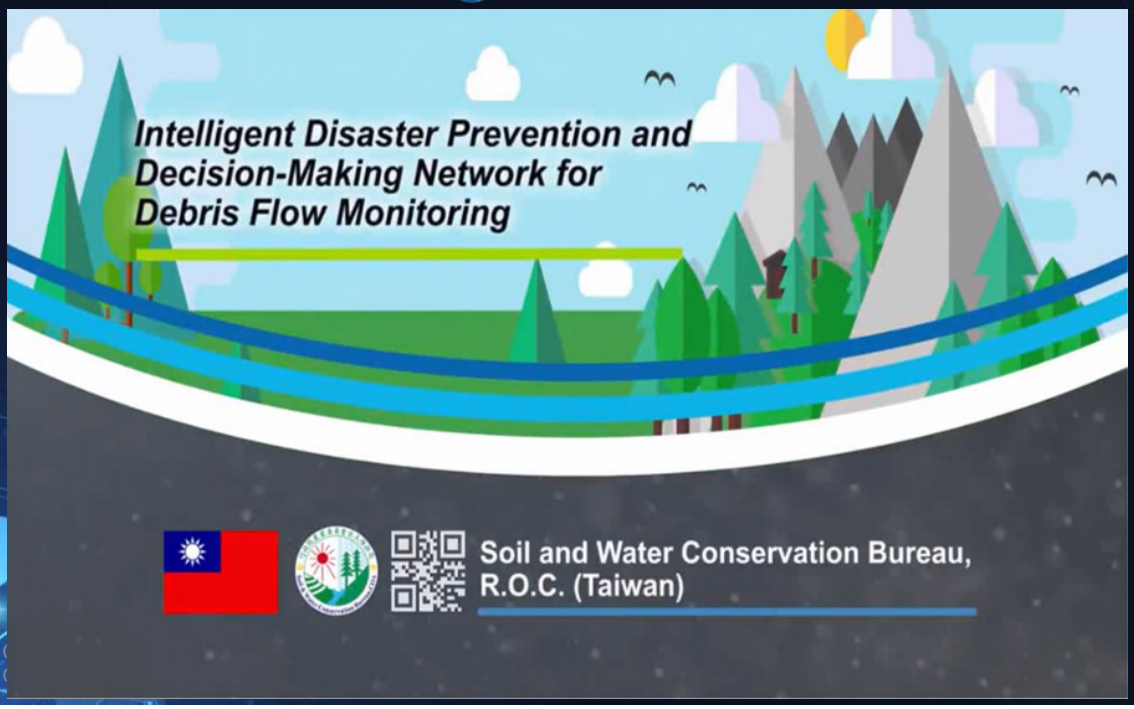
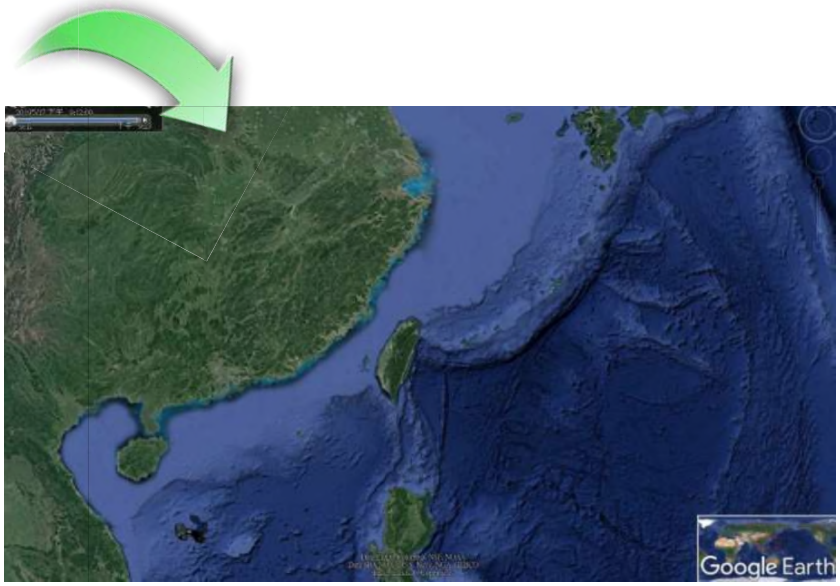
Group on Earth Observation (GEO)
- Landslide Scenario in Disaster Pilot

GEO GROUP ON

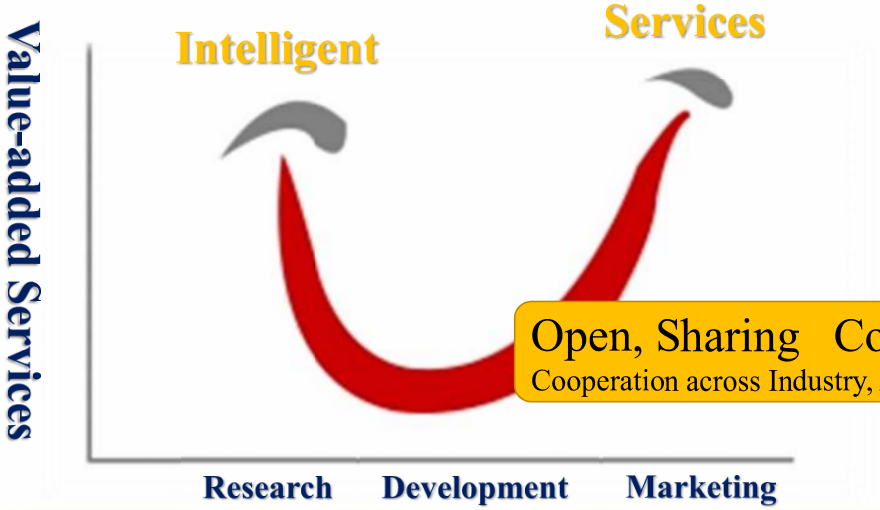



# AI image recognition to 3D map platform




## Smiling curve

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