

# Development of SRU Definition Guidelines and a Reserve Reporting Code

**Dr. Carlos D. Espejel Garcia**

Ispace, University of Luxembourg,  
University of New South Wales, European Space Agency

Supervisors: Julien-Alexandre Lamamy, Serkan Saydam, Tonie Van Dam  
External Supervisor: James Carpenter

**Project funded and supported by the  
Luxembourg National Research Fund (FNR)**

**Sophia C. Casanova**

University of New South Wales

Supervisors: Serkan Saydam & Andrew Dempster  
External Supervisors: Graziella Caprarelli, Robert Anderson

**Research funded and supported by the  
UNSW Postgraduate Award and AusIMM Endowment Fund**



# Resource and Reserve Statements and Public Reporting

## Public Reports:

- Prepared for the purpose of informing investors or potential investors on *exploration results*, *resource* and *reserve estimates*
- May also be prepared to satisfy regulatory requirements
- Include (but not limited to) annual and quarterly reporting, press releases, technical papers, website posting and public presentations
- Contain all *relevant information* required for the reader to make a *reasoned* and *balanced judgement*
- Compliant with relevant listing rules and reporting codes

## Reporting Codes Provide:

- The minimum standards for public reporting
- A *framework* for resource and reserve classification
- A consistent approach to evaluate development projects and present results
- An agreed upon set of *definitions* / *glossary* of commonly used terms
- Recommendations and guidance for *transparent*, *consistent* and *comparable* reporting

## Resource and Reserve Statements:

- Benchmark for company performance and outlook
- Inform internal company business strategy and decision-making



# Examples of Existing Terrestrial Reporting Codes

- Joint Ore Reserves Committee (JORC -2012)
- Committee for Mineral Reserves International Reporting Standards (CRIRSCO 2013)
- Petroleum Resources Management System (PRMS 2018)
- United Nations Framework Classification For Fossil Energy And Mineral Reserves And Resources 2009 (UNFC – 2009)



# Joint Ore Reserve Committee (JORC)

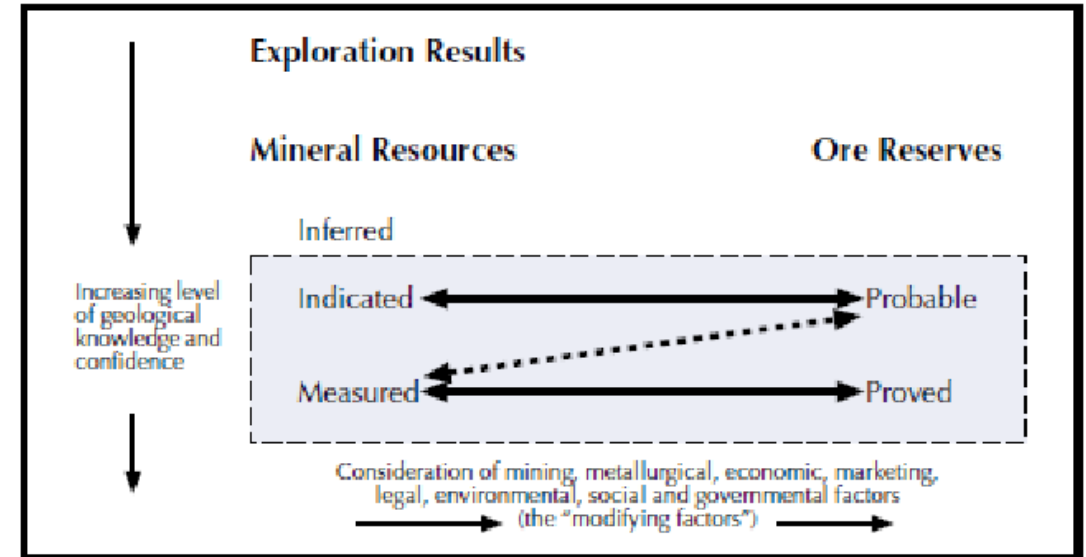


Governing principals: transparency, materiality and competence

Incremental risk - based classification

Classification categories:

- Exploration Targets and Results
- Mineral Resources
- Ore Reserves



Source: JORC 2012



# PETROLEUM RESOURCES MANAGEMENT SYSTEM (PRMS 2018) - SPE



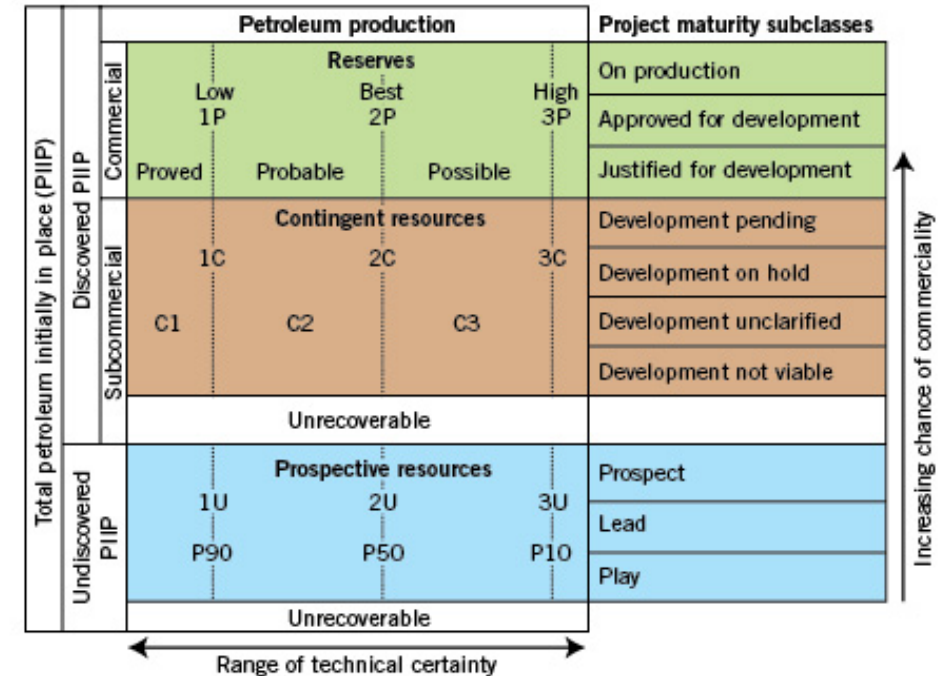
The most widely used reporting code by the Oil and Gas (O&G) industry

Project based system

Probabilistic or deterministic volume modelling

Classification based on project maturity

- Prospective Resources (1U,2U,3U)
- Contingent Resources (1C,2C,3C)
- Reserves (1P, 2P, 3P)



Source: PRMS 2017, SPE

**Horizontal axis:** Recoverable volume - range of uncertainty

**Vertical axis:** Chance of commercial development



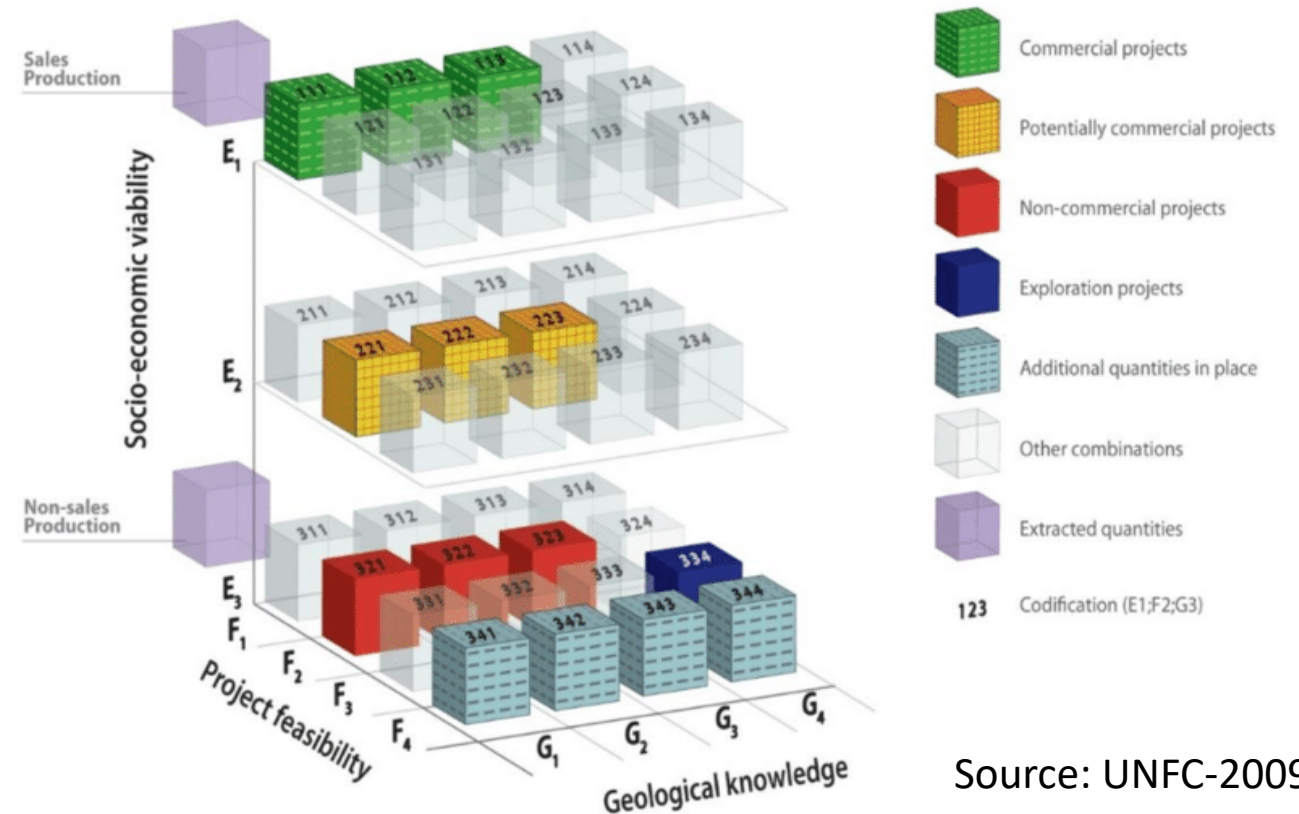
# UNITED NATIONS FRAMEWORK CLASSIFICATION FOR FOSSIL ENERGY AND MINERAL RESERVES AND RESOURCES 2009 (UNFC – 2009)



Three-dimensional system :

- **Economic and social viability (E),**
- **Field project status and feasibility (F) and**
- **Geological knowledge (G)**

Uses a numerical classification coding scheme



Source: UNFC-2009



# Requirements for Developing a Reserve Reporting Code

- *Clear* and *consistent* definition and classification system
- Take into account the unique environment in which SRU activities considering application to *differing resource types, extraction methods, data collection constraints, operational / market conditions*
- *Inclusive* – developed in co-operation/collaboration with *private sector, governmental bodies* and *agencies, researchers, professional associations* and *expert individuals*
- Reflect differing stakeholder requirements



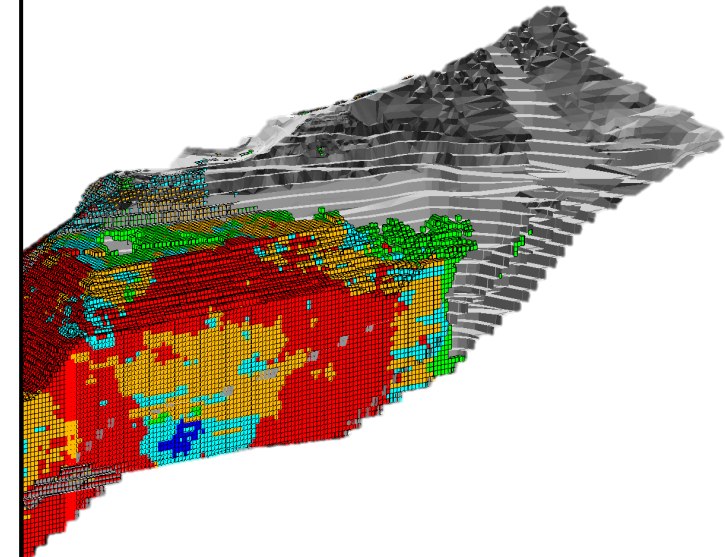
# Lunar Ore Reserves Standards (LORS-101)

## Dr. Carlos D. Espejel Garcia

### Lunar Ore Reserves Standards LORS 101

Dr. Carlos Daniel Espejel Garcia

ispace  
University of Luxembourg  
University of New South Wales  
European Space Agency  
University of Queensland





# OBJECTIVES OF LORS 101

LORS will be designed to provide the first guidelines to future *private companies, space agencies, and other entities* that would like to *prospect / explore, extract* and *use* space resources (**Moon**, Mars, Asteroids, etc.) in a clear and responsible manner.

The guidelines will focus mainly (but not limited to) on how to report the following:

1. **Exploration Results**
2. **Mineral and Volatiles Resources**
3. **Mineral and Volatiles Reserves**

LORS will also include:

- **Licensing and Leases**
- **Social and Environmental Responsibility**
- **Glossary of SRU and LRU definitions**

LORS will be based on existing standards currently used on Earth by the *Mining industry, Oil and Gas industry* and the *United Nations*.



# LORS-101 SUGGESTED COMMITTEE – ORGANISATIONS

- ESA
- LSA (Luxembourg Space Agency)
- Luxembourg National Research Fund (FNR)
- University of Luxembourg
- University of New South Wales - Australia
- University of Queensland (SMI) - Australia
- JORC
- AusImm (Australian Institute of Mining and Metallurgy)
- Industry: World Top 3 – Mining Company
- The Hague Space Resources International Working Group
- CRIRSCO (Committee for Mineral Reserves International Reporting Standards)
- SPE (Society of Petroleum Engineers)
- UN



# LORS COMMITTEE – EXPERT INDIVIDUALS

Dr. Carlos Espejel (FNR, UNSW, ispace, Mining Industry) – LORS Structure Definition, and Author of Identified Chapters.

Professor Alice Clarks (JORC & SMI) – LORS Peer Review

Sophia Casanova (UNSW and Oil & Gas Industry) – Volatiles Exploration and Resources

Rhonda Sullivan (Mining Industry) – Minerals Exploration

Dr. Abigail Calzada (Space Science) – Lunar Geology and Lunar Exploration, Environment (Science)

Professor Rick Valenta (Mining Industry) – Reporting of Exploration and Mineral Resources

Professor Serkan Saydam (Mining Industry) – Peer Review on Reserves Estimation

Tonie Van Dam (Space Science) – Exploration Technology

Julien-Alexandre Lamamy (Space Engineering) – Space and SRU Technology



# LORS – STEPS FORWARD

- LORS preliminary framework – available end of October
- Develop the SRU and LRU glossary of definitions
- LORS Committee – Continue to coordinate work with the expert individuals and seek involvement from additional expert individuals and organisations
- Investigate where to house LORS (i.e. existing entity or create new entity)
- Present LORS 101 and glossary of SRU and LRU at key conferences





## Dr. Carlos D. Espejel Garcia

Ispace, University of Luxembourg,  
University of New South Wales, European Space Agency

Supervisors: Julien-Alexandre Lamamy, Serkan Saydam, Tonie Van Dam

External Supervisor: James Carpenter

**Project funded and supported by the  
Luxembourg National Research Fund (FNR)**

## Sophia C. Casanova

University of New South Wales

Supervisors: Serkan Saydam, Andrew Dempster,  
External Supervisors: Graziella Caprarelli, Robert Anderson

**Research funded and supported by the  
UNSW Postgraduate Award and AusIMM Endowment Fund**