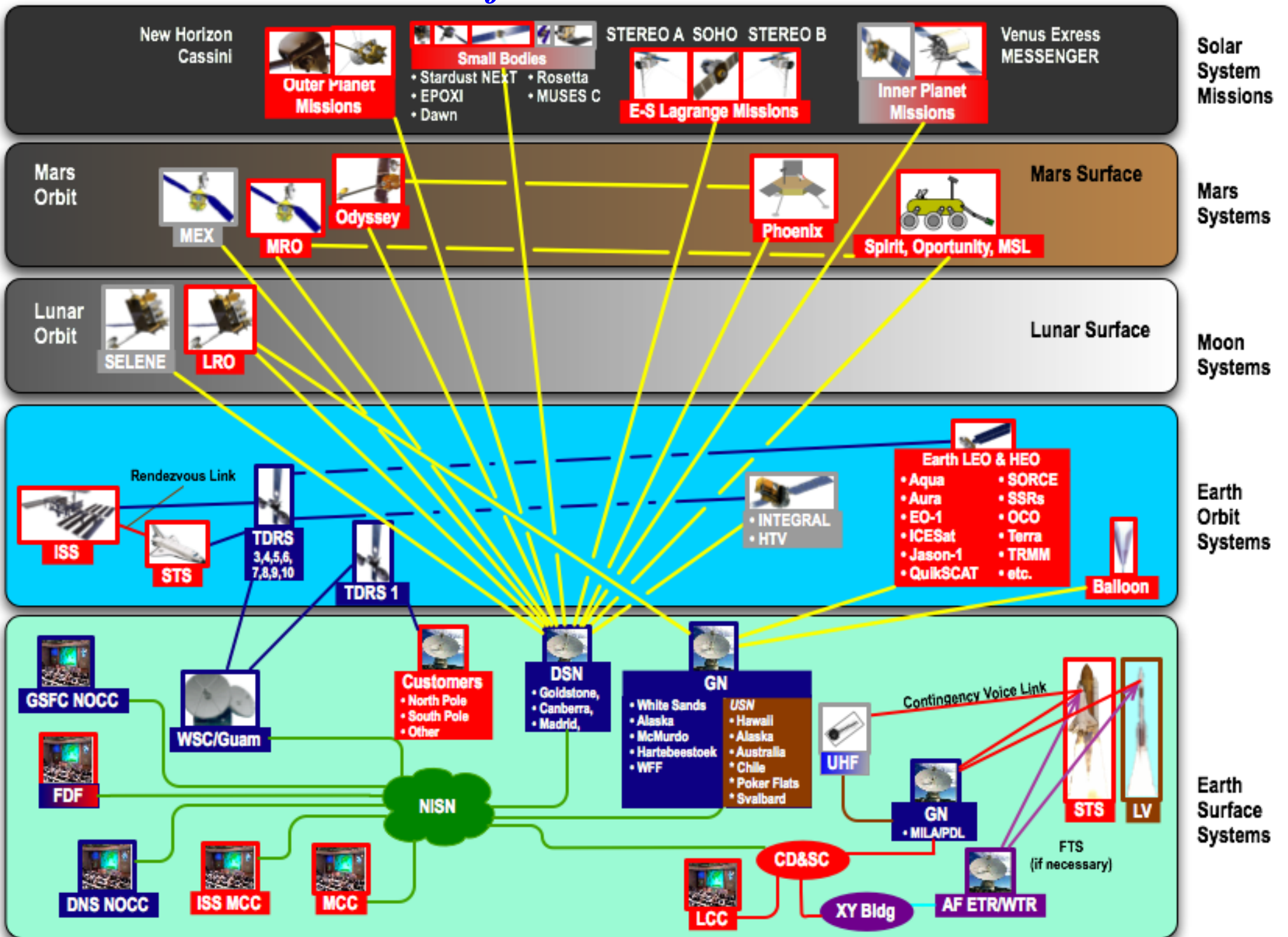




Space Communications and Navigation (SCaN) Program Commercial & International Lunar Communications and Navigation Studies

Calvin Ramos
(for Jim Schier)
13 May 2008

DRAFT SCaN Interface with Customers/Missions





State of “Commercial” in SCaN



- Space Network (SN)/Tracking & Data Relay Satellite System (TDRSS) is & will remain Government Owned/Government Operated (GOGO)
- Deep Space Network (DSN) is GOGO; contains significant unique technology not in industry; no market beyond NASA
 - Not a good candidate for commercialization
- Ground Network (GN) is ~1/3 GOGO & 2/3 Contractor Owned & Operated (COCO) in transition to 90% COCO
- NASA Integrated Services Network (NISN) runs entirely on AT&T
- Lunar Network (LN) conceived to support Science & Exploration missions
 - Subject of new commercial and international study



Science & Exploration Drivers



- SMD - ILN of 6-12 surface stations
- ILN Kickoff (12 March 2008) - open to participation by all national space agencies
- Initial lunar surface stations in the geophysical network may launch as early as 2011 (UK) or 2013 (US)



Science & *Exploration Drivers*



- ESMD Studies to date have treated Communication & Navigation (C&N) as if entirely provided by NASA
 - Lunar Architecture Team Phase 1 & 2 (2006-2007)
 - Constellation Architecture Team Lunar Surface Systems (CxAT LSS) (2008)
- Initial *Altair* lunar lander test in 2019 followed by 2 missions/year
- *Vision for Space Exploration* goal & NASA Authorization Act of 2005 direction is to “promote international and commercial participation in exploration”



Looking for Wider Participation



- Science & Exploration plans offers a natural evolutionary path for Communications and Navigation capabilities
 - 2010's: Initial support for increasing number of lower rate science stations scattered over near & far side
 - 2020's: Expanded support for human missions with establishment of Lunar Outpost and sortie missions anywhere on Moon
- Both programs plan to incorporate major contributions from international partners
- Exploration plans & ILN may benefit from commercial partners
- *It's time to open up & examine commercial & international opportunities for lunar C&N*



Roadmap: Plans & Opportunities



2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

Science Missions



- *ILN Launch dates to be coordinated among ILN Partners to maximize number of simultaneous surface stations*



Exploration Missions

Space Communications and Navigation

Interoperable Spectrum & Standards

- Strategy** ◆ ILN Strategy Agreement 12/2008
- Spectrum** ◆ ILN Spectrum Agreement ◆ Exploration Phase 2 Agreement
- Standards** ◆ ILN Standards Agreement ◆ ILN Stds Implemented ◆ Expl Phase 2 Standards Implemented ◆ Expl Phase 2.2 Stds

Technology Flight Demos & Testbeds



Potential ILN Relay Testbed

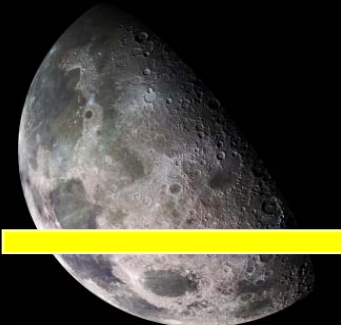
LRS Testbed

Operational Systems

Potential ILN Relay

Lunar Relay Satellite (LRS)

- *Potential ILN Relay launch date determined by need to cover far side stations*





Objectives of Commercial Lunar C&N Study

(First phase: Now – December 2008)



- Define “essential C&N” in sufficient detail to enable partitioning lunar C&N performance into the portion that NASA will supply and the portion that is eligible for commercial services
- Assess potential market for commercial lunar C&N services
- Develop a recommended strategy for NASA to follow that will enable NASA to effectively and fairly evaluate commercial options
- Enable industry to collaborate in further architecture development
- This strategy should address concerns from industry’s perspective such as business environment, profit, and business risk as well as NASA’s concerns.
 - Identify barriers to commercialization and ways to mitigate them;
 - Identify enablers of commercialization and ways to foster them;
- Identify other recommendations that would contribute to a successful joint effort between NASA and industry to create a commercial lunar C&N market; and
- Define plans for subsequent phase(s) of Lunar Commercial C&N Studies.



Commercial Lunar C&N Study



- Approach
 - Use RFIs and US Chamber of Commerce Space Enterprise Council (USCC-SEC) to solicit participation from industry focusing outside of traditional aerospace players
 - Parallel NASA & industry teams to define “essential C&N”, i.e., what does NASA commit to providing & what is the commercial opportunity?
 - Conduct assessment of potential lunar C&N market
 - Business as normal (NASA acquires whatever capability it needs)
 - If NASA/Industry jointly pursue strategies to foster commercial opportunities
 - Hold workshops for industry & NASA to collaborate on strategy to enable commercialization
 - Prepare report on recommended strategies for NASA & Industry to pursue



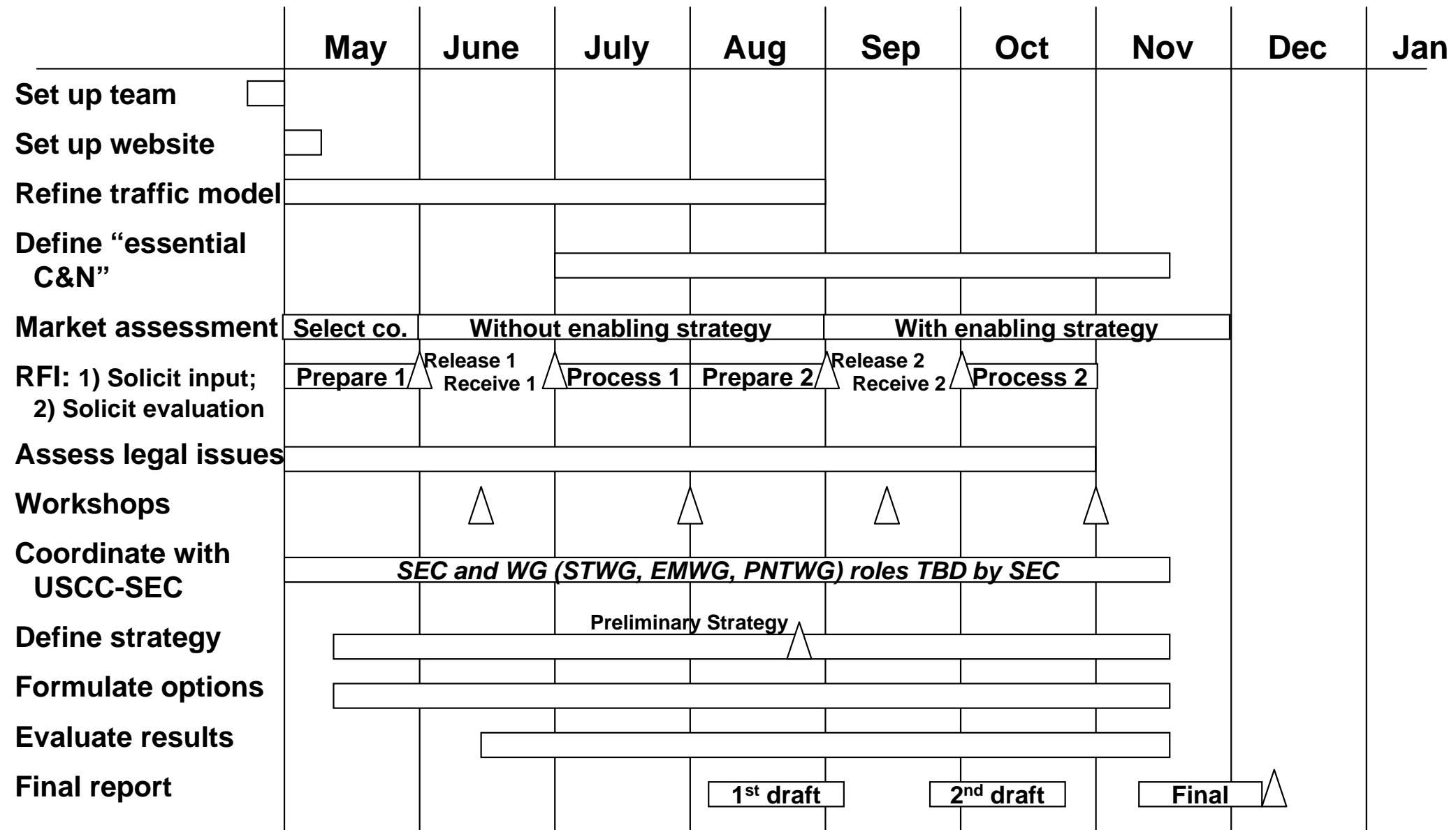
Commercial Lunar C&N Study



- Participants:
 - USCC-SEC acting as industry body to enable open participation
 - Market assessment to be done by commercial firm with established industry reputation for independent market analysis
 - Open to all commercial entities that want to explore possibilities of investing in lunar C&N



Near Term Plan – Commercial





International Lunar C&N Study



- First phase: Now – December 2008
- Purposes:
 - Establish Terms Of Reference (TOR) for ILN Communications approach
 - Establish means for coordinating international C&N needs to support ILN including
 - Spectrum
 - Standardized navigation services
 - Standardized data and networking protocols
 - Tracking, Relay, & Network (TRAN) opportunities including space & ground capabilities
 - Establish database of C&N needs for those ILN contributions identified this year
 - Establish framework for evolving interoperability from ILN in 2010's to Human Exploration in 2020's



International Lunar C&N Study



- Approach:
 - Use Interagency Operations Advisory Group (IOAG) for identification of needs
 - Expand participation to all ILN partners
 - Use Space Internetworking Strategy Group (SISG) as technical WG
 - Use Space Frequency Coordination Group (SFCG) to establish agreements on spectrum usage
 - Spectrum architecture should be consistent for ILN & Exploration
 - Use Consultative Committee on Space Data Systems (CCSDS) to establish roadmap for standards
 - Standards architecture should evolve gracefully from ILN to Exploration
 - Coordinate within NASA between Space Operations Mission Directorate's Space Communications and Navigation (SCaN) Office, Science MD (SMD), Exploration Systems MD (ESMD), and Office of External Relations on strategy & driving requirements
 - Coordinate with SMD Planetary Science Division's ILN Working Groups on Instrument Selection and Site Selection
 - SCaN coordinates C&N needs across Science & Exploration and acts as NASA lead for external negotiations
 - Present final recommendations to Interoperability Plenary (IOP) #2 (Geneva, week of 12/8) & to ILN Partners (December)



International Lunar C&N Study



- Participants:
 - NASA: SMD Planetary Science Division, SCan, OER, ESMD
 - International: All agencies that are signatories to the Global Exploration Strategy are invited to participate
 - Current principal IOAG participants are NASA, ESA, JAXA, ASI, CNES, DLR



Near Term Plan – International

