CLARREO Mission Status

- Passed Mission Concept Review Nov 2010
- Science Definition Team selected in Jan 2011
- NASA Earth Science budget reduction in Feb 2011 has caused a delay.
- Remains in pre-phase A studies, no current launch date
- 2 RS and 2 IR instrument calibration demonstration systems underway (CU-LASP/GSFC for RS, UW/LaRC for IR)
- Climate Model OSSEs and Intercalibration simulation studies
- Alternative less costly mission studies: ISS best option to date
- International collaboration options with UK, Italy in study
- No climate observing system: factor of 3 to 4 underfunded
2013 Progress: Journals

• 26 journal papers published/in press in 2013

• 15 papers submitted/in review

• 42 papers in preparation

• 13 journal papers were published in 2012

• This SDT meeting will give us a fresh view of science study progress and directions
A MEASURE FOR MEASURES

In-Orbit Calibration of Climate-Change Monitoring
Intercalibration to CLARREO for Climate Change Accuracy

Intercalibration of 30 to 40 instruments in LEO and GEO orbits

NASA
Economic Value of Climate Observations

Value of information for climate observing systems

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Abstract

The Interagency Working Group Memo on the social cost of carbon is used to compute the value of information (VOI) of climate observing systems. A generic decision context is posed in which society switches from a business as usual (BAU) emissions path to a reduced emissions path upon achieving sufficient confidence that a trigger variable exceeds a stipulated critical value. Using assessments of natural variability and uncertainty of measuring instruments, it is possible to compute the time at which the required confidence would be reached under the current and under a new observing system, if indeed the critical value is reached. Economic damages (worldwide) from carbon emissions are computed with an integrated assessment model. The more accurate observing system acquires the required confidence earlier and switches sooner to the reduced emissions path, thereby avoiding more damages which would otherwise be incurred by BAU emissions. The difference in expected net present value of averted damages under the two observing systems is the VOI of the new observing system relative to the existing system. As illustration, the VOI for the proposed space-borne CLARREO system relative to current space-borne systems is computed. Depending on details of the decision context, the VOI ranges from 2 to 30 trillion US dollars.

Electronic supplementary material

The online version of this article (doi:10.1007/s10669-013-9451-8) contains supplementary material, which is available to authorized users.

Keywords: Value of information - Climate observing system - Social cost of carbon - DICE - CLARREO
## World Wide Economic Benefits

<table>
<thead>
<tr>
<th>Parameter Change</th>
<th>CLARREO/Improved Climate Observations VOI (Trillion US 2015 dollars, NPV) 3% discount rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline*</td>
<td>$11.7 T</td>
</tr>
<tr>
<td>BAU =&gt; AER</td>
<td>$9.8 T</td>
</tr>
<tr>
<td>0.3C/decade trigger</td>
<td>$14.4 T</td>
</tr>
<tr>
<td>2030 launch</td>
<td>$9.1 T</td>
</tr>
</tbody>
</table>

* Baseline uses 0.2C/decade trigger, 95% confidence in trend, BAU => DICE optimal emissions, 2020 launch

- Delaying launch by 10 years reduces benefit by $2.6 T

Each year of delay we lose $260B of world benefits
2013 Progress: Instruments

• UW Instrument Incubator Program (IIP) demonstrated space environmental testing to reach TRL-6 on their CLARREO prototype infrared (IR) interferometer

• LaRC IR Calibration Demonstration System (CDS) held successful NIST peer review: now within a factor of 2 of CLARREO requirements with next step to implement small nonlinearity corrections

• CU LASP IIP successful high altitude balloon flight (30km) of their CLARREO prototype reflected solar (RS) spectrometer with solar and lunar views

• GSFC RS CDS held successful NIST peer review, and participated in Landsat ground calibration campaign. On schedule for their successive accuracy steps to CLARREO levels.
ISS Mission Concept

• Selected the Japanese Experiment Module Exposed Facility (JEM-EF) for this study
  o L/V, installation and JEM-EF interfaces defined and provided by ISS
  o Other ISS locations viable, but ram-side of JEM-EF is optimal for maximizing viewing opportunities

• Dual-instrument payload approach demonstrated by NRL’s HREP
2014 Directions

• Extend the science understanding of CLARREO requirements

• Support the next Decadal Survey

• Educate the world on why CLARREO is a critical part of any climate observing system

• Continue to reduce mission costs and risks
2014 Key Tasks

• Key journal papers we still need to publish

• Refining CLARREO requirements as a function of wavelength using new science studies in combination with IIP and CDS instrument calibration studies

• Instrument Design sessions to look at smaller, lighter, less expensive instrument designs

• Summary Report for CLARREO web site and for background support of decadal survey white paper

• Decadal Survey schedule and White Paper
Decadal Survey Schedule

- NASA/NRC negotiating terms of study now
  - missions as in the last decadal survey? likely NRC preference
  - science topics and priorities? likely NASA preference
  - white paper content may or may not be set in study terms

- Expected selection of study members in spring 2014

- Early meetings of committee in summer 2014

- Expected call for White Papers: Jan 2015

- Expected due date for White Papers: June 2015

- Final report due out in 2017
Presentation & Team Discussion of 2014 Tasks

Thursday Morning (1 hour)