# Light Microscopy Module (LMM)/ Constrained Vapor Bubble (CVB)


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## *Objective:*

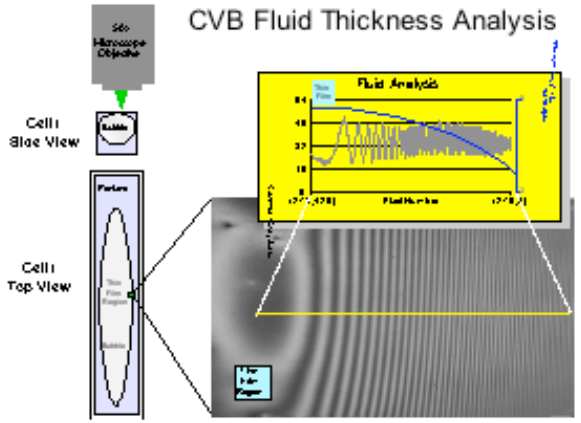
- To determine the overall stability, the fluid flow characteristics, the average heat transfer coefficient in the evaporator, and heat conductance of the constrained vapor bubble, under microgravity conditions, as a function of vapor volume and heat flow rate.

## *Relevance/Impact:*

- CVB is crucial for engineering heat pipes for space applications.
- CVB flow induced by capillary flow eliminating need for wicks.
- Data from CVB will lead to optimally designed heat pipes that will operate at full capacity and provide large weight savings.
- CVB will provide the understanding of the maximum achievable performance of simple heat pipes based on corner flows.
- LMM provides the capability to identify contaminates in the crew environment without the need to return samples to earth for evaluation.
- LMM provides capability to quantify blood samples of crew members for flight surgeon analysis.
- LMM provides capabilities to identify microorganisms with a broad suite of optical diagnostics including fluorescence microscopy.

## *Development Approach:*

- The CVB/LMM is designed for autonomous operation through scripts and ground commanding. Crew time is required for initial installation and check out in the Fluids Integrated Rack (FIR), sample change out, and removal from FIR.
- The LMM and CVB flight hardware was developed under a proto-flight approach with the exception of the CVB module which follows the traditional qual/flight approach. The CVB modules will have spares, all other spare hardware will be kitted and assembled as required.
- The LMM and CVB are designed to utilize the FIR capabilities to the maximum extent possible.




## *ISS Resource Requirements*

| | |
|---|---|
| **Accommodation (carrier)** | Fluids Integrated Rack (FIR) |
| **Upmass (kg)** (w/o packing factor) | 203 Kg for CVB/LMM |
| **Volume ($m^3$)** (w/o packing factor) | 0.09 CVB/LMM |
| **Power (kw)** (peak) | 0.5kw for CVB/LMM<br>1.1 kw for FIR/CVB/LMM |
| **Crew Time (hrs)** (installation/operations) | 34 Hours |
| **Autonomous Operations** | 2wks/module 5 modules = 10 wks |
| **Launch/Increment** | 17A/Increment 19 |

## *Project Life Cycle Schedule*

| Milestones | SCR | RDR | PDR | CDR | VRR | Safety | FHA | Launch | Ops | Return | Final Report |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Actual/ Baseline** | 9/97<br>CVB | 12/98<br>CVB | 2/02<br>LMM/CVB | 12/03<br>LMM/CVB | 8/04<br>LMM/CVB | Phase III<br>11/05 | 12/07 | 4/09 | Inc. 19/20 | TBD | 2011 |