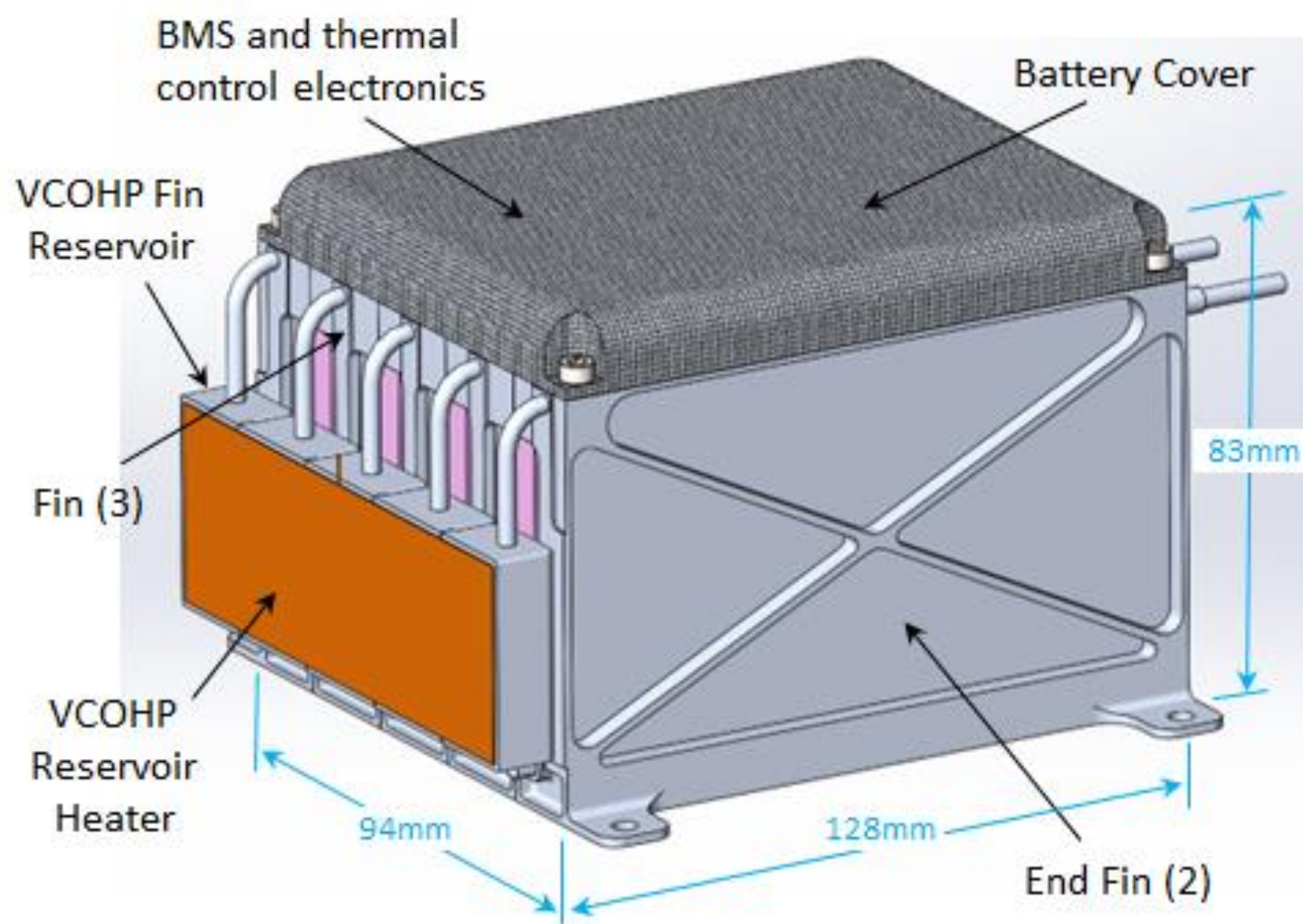


# FY23 Innovative Spontaneous Concepts Research and Technology Development (ISC)

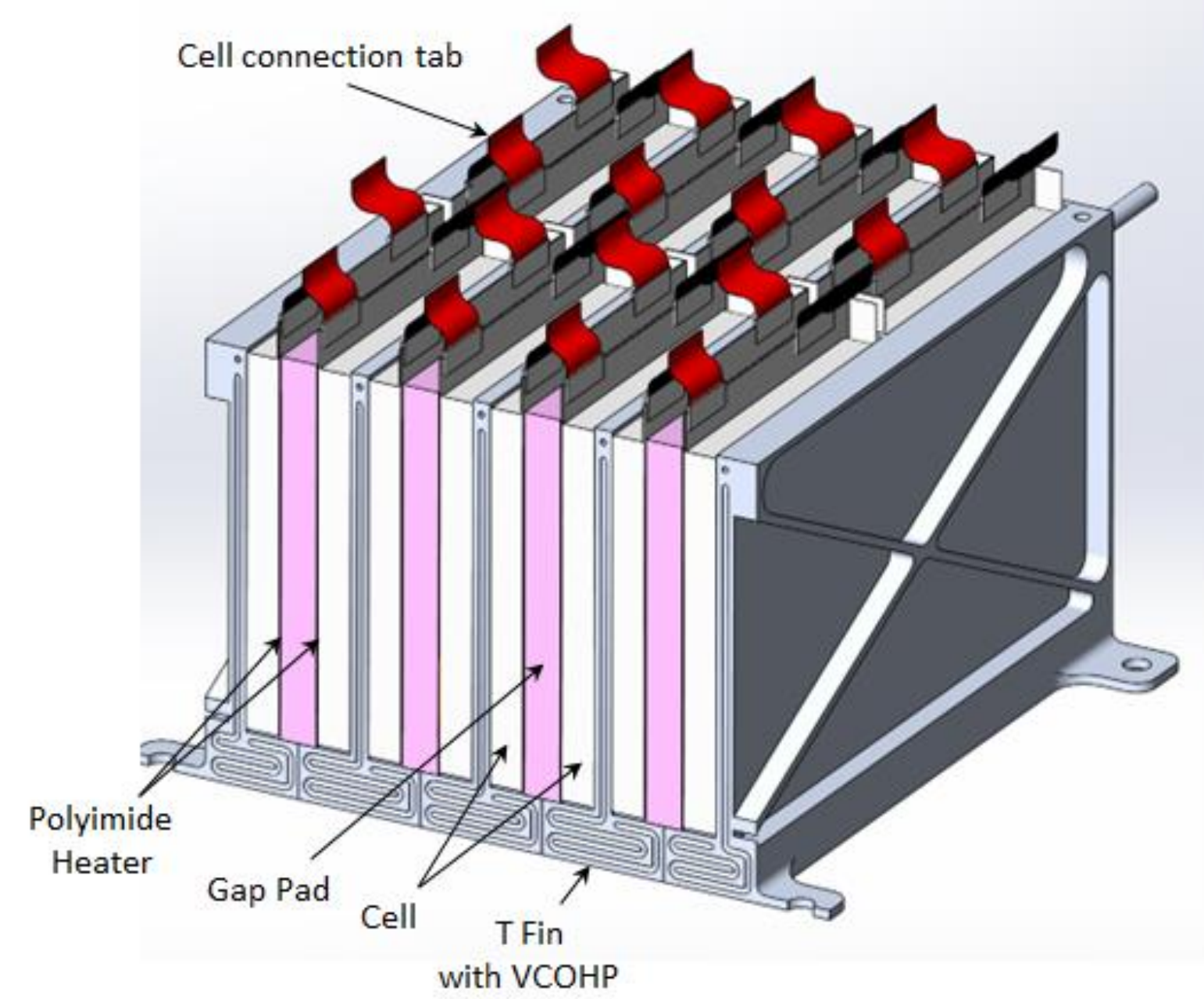
## Design of Space Rated Pouch Cell Battery Module

**Principal Investigator:** Erik Brandon (346); **Co-Investigators:** Eric Poliquin (346), Takuro Daimaru (353), Michael Cox (353), William West (346)

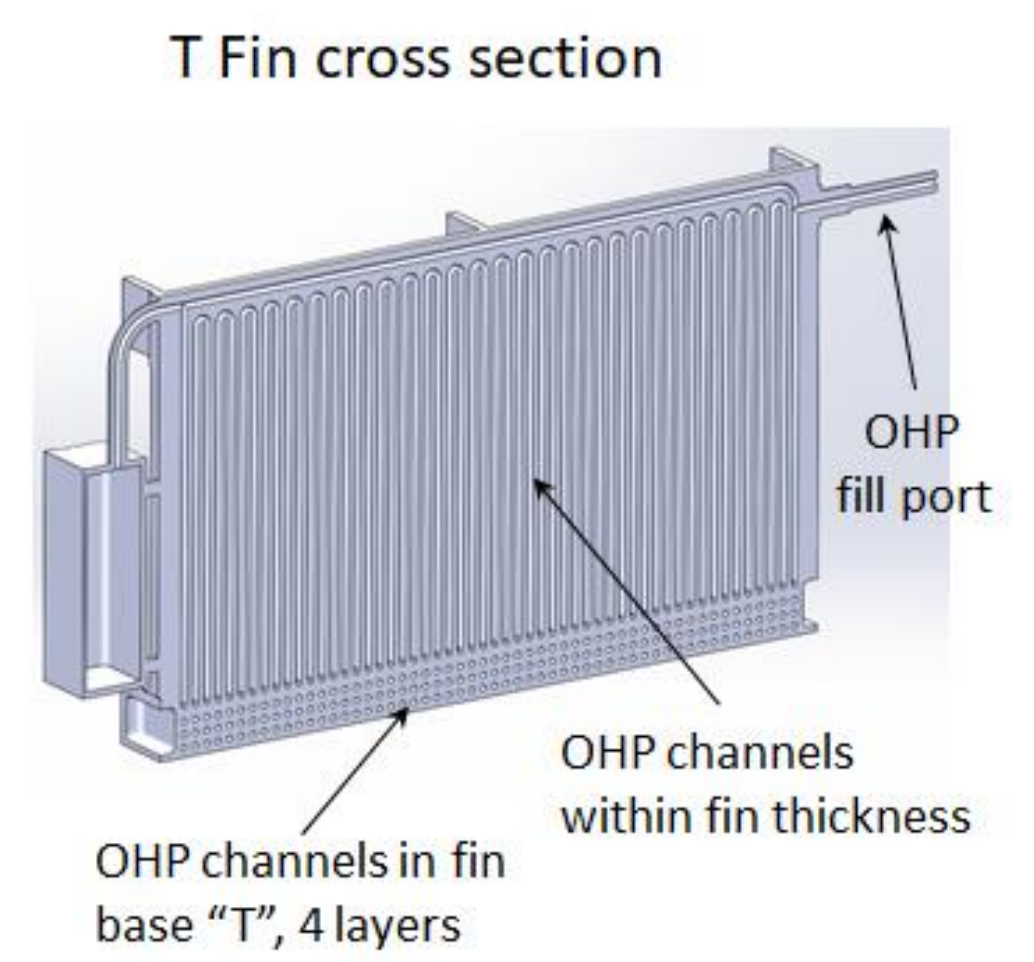
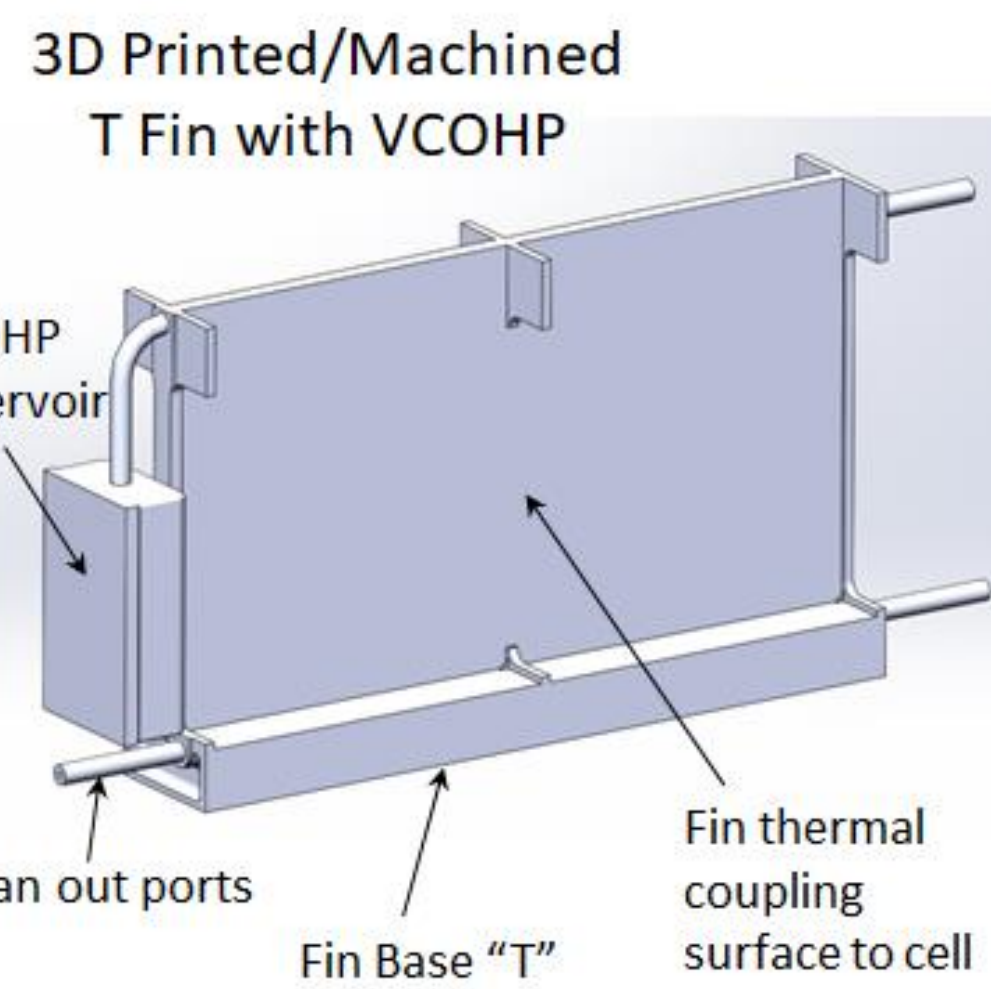
**Objectives:** The key objective of this task was to design a viable space rated multi-cell battery module based on pouch/laminate cells, targeting a module level specific energy of >200 Wh/kg. Related objectives included completing both an initial thermal analysis of the design and a set of detailed and released drawings, to support a follow-on prototyping effort for performance testing and flight qualification of the multi-cell module.



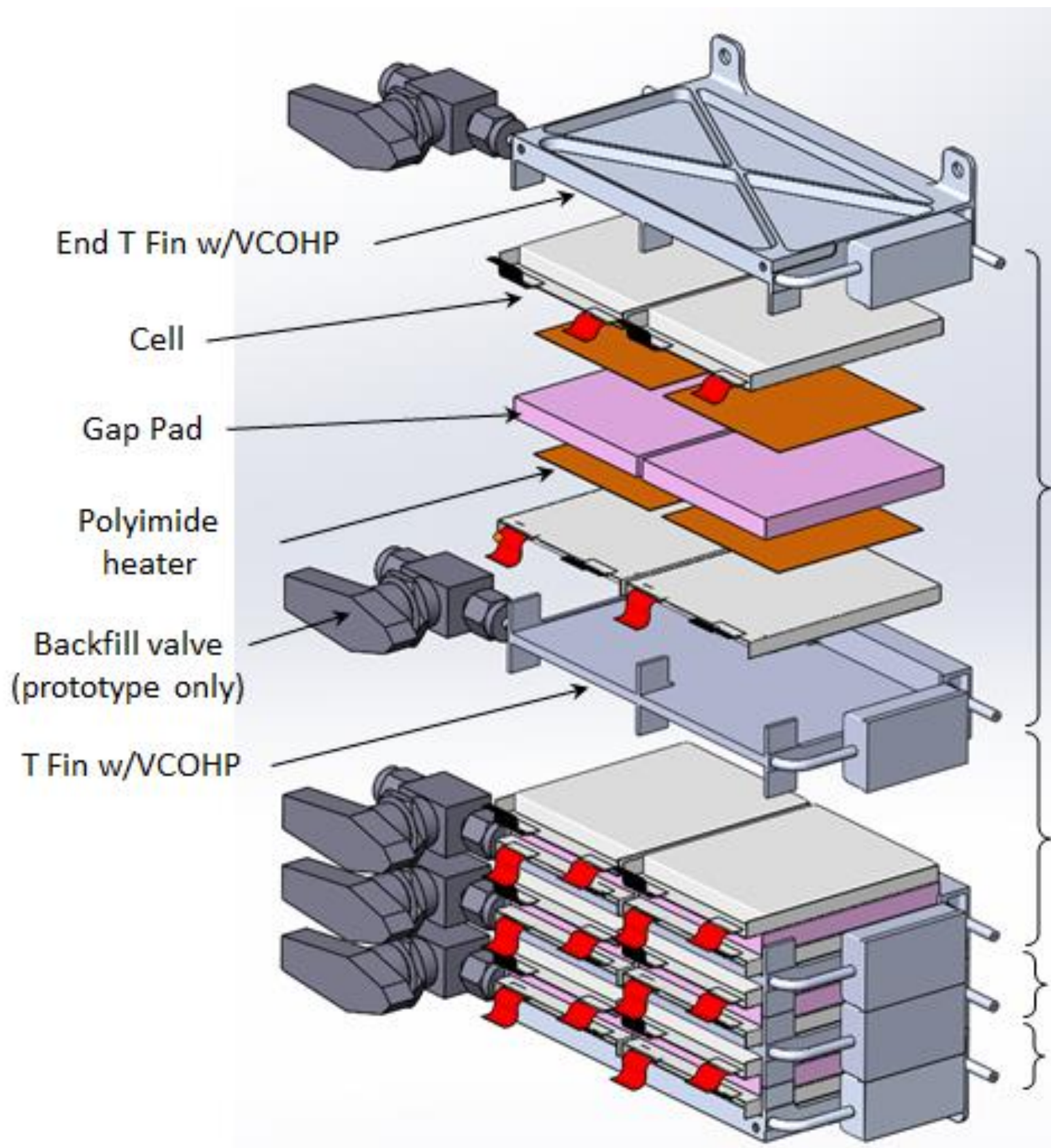
**Pouch cell battery module concept**



**Module cross-section**



**Variable Conductance Oscillating Heat Pipe Fin Detail**



DESIGN 1G - W/VCOHP			
DESCRIPTION	MASS (g)	QTY.	TOTAL MASS (g)
End fin	104.4	2	208.8
Fin	108.12	3	324.36
cell	45	16	720
Gap pad	13.7	8	109.6
Cover	20.4	1	20.4
Coverscrew (Ti)	0.4	4	1.6
Cell heaters	1.29	16	20.64
Reservoir heater 31.4cm <sup>2</sup>	1.57	1	1.57
<b>Total</b>			<b>1407</b>
Power (Wh)	304		
<b>Wh/kg</b>			<b>216.1</b>

DESIGN 1F - W/1mm Fin (no OHP)			
DESCRIPTION	MASS (g)	QTY.	TOTAL MASS (g)
End fin	39.7	2	79.4
Fin	29	3	87
cell	45	16	720
Gap pad	13.7	8	109.6
Cover	18.6	1	18.6
Coverscrew (Ti)	0.4	4	1.6
Cell heaters	1.29	16	20.64
<b>Total</b>			<b>1037</b>
Power (Wh)	304		
<b>Wh/kg</b>			<b>293.2</b>

**Exploded view of module assembly**

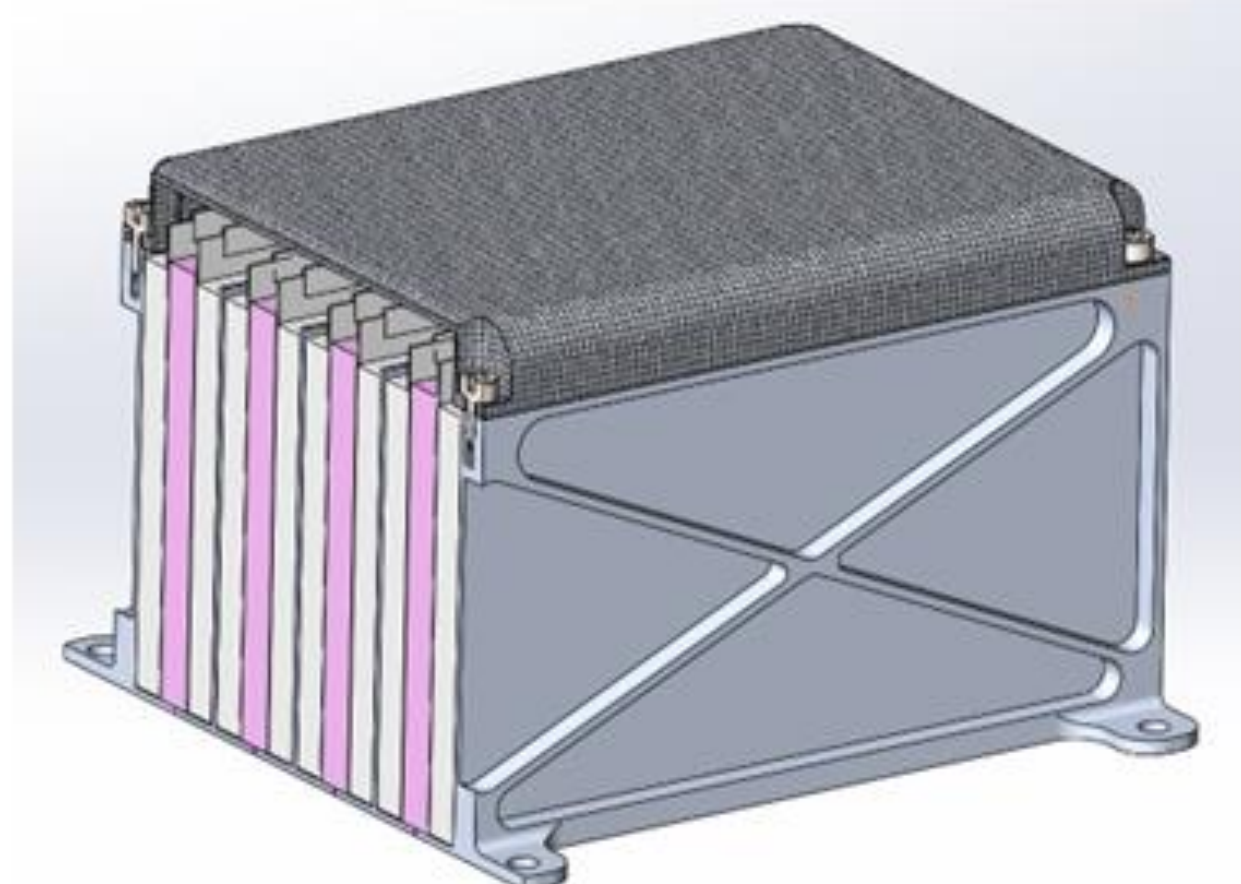
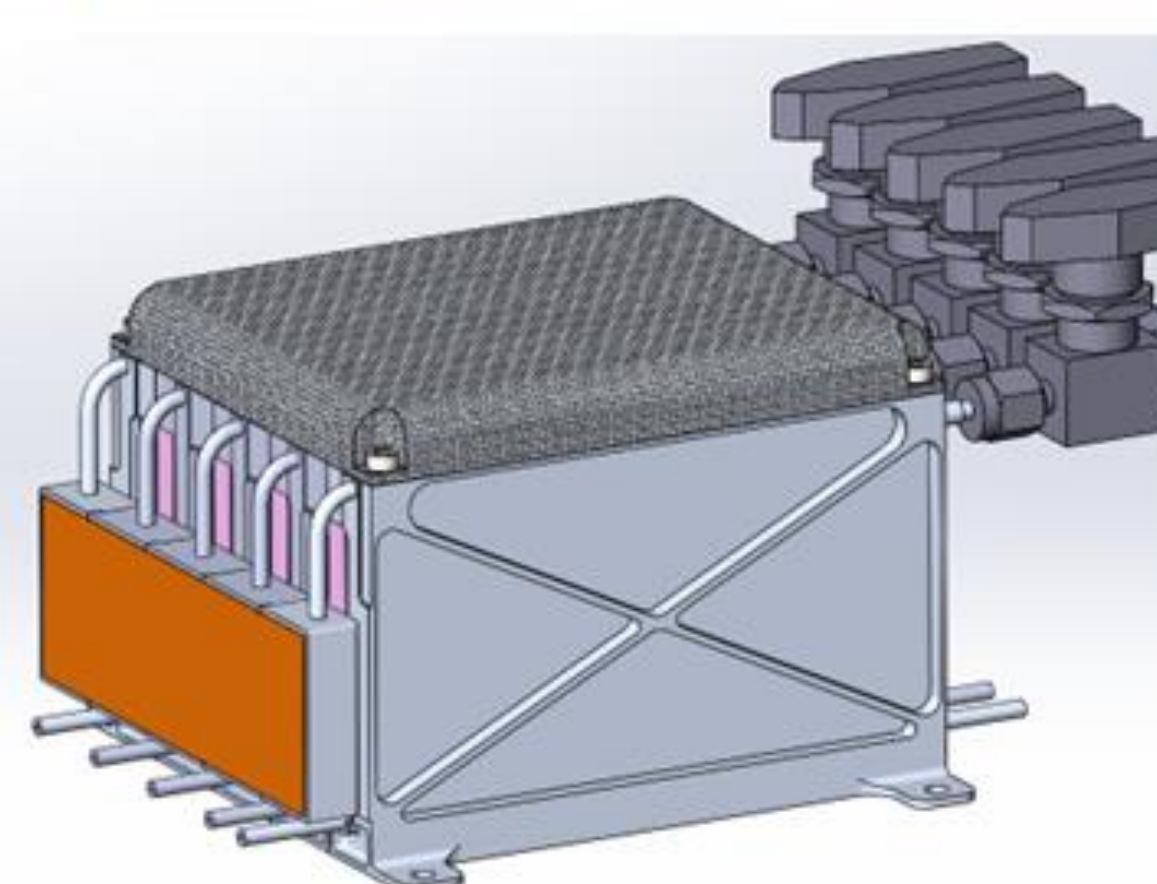
National Aeronautics and Space Administration

Jet Propulsion Laboratory  
California Institute of Technology  
Pasadena, California

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**216 – 293 Wh/kg vs.  
state of practice  
modules at ~150  
Wh/kg**



**Specific energies for two module designs using ~400 Wh/kg pouch cells**

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