



Overview of 50m Drop Tower “COSMOTORRE”



COSMOTORRE
コスモトルレ

Further questions on this material could be addressed to:
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This info is as of March 26,2020

Contents

- 1. Why Microgravity?**
- 2. 50m drop tower “COSMOTORRE”**
- 3. Research projects on combustion science**

Why Microgravity? (1)

-Simplification-



- **Simplification**
- **Elementary process**

No buoyancy force



Elimination of convection



**Simplification of
combustion phenomena**



**Deep understanding of
elementary processes
composes of combustion**

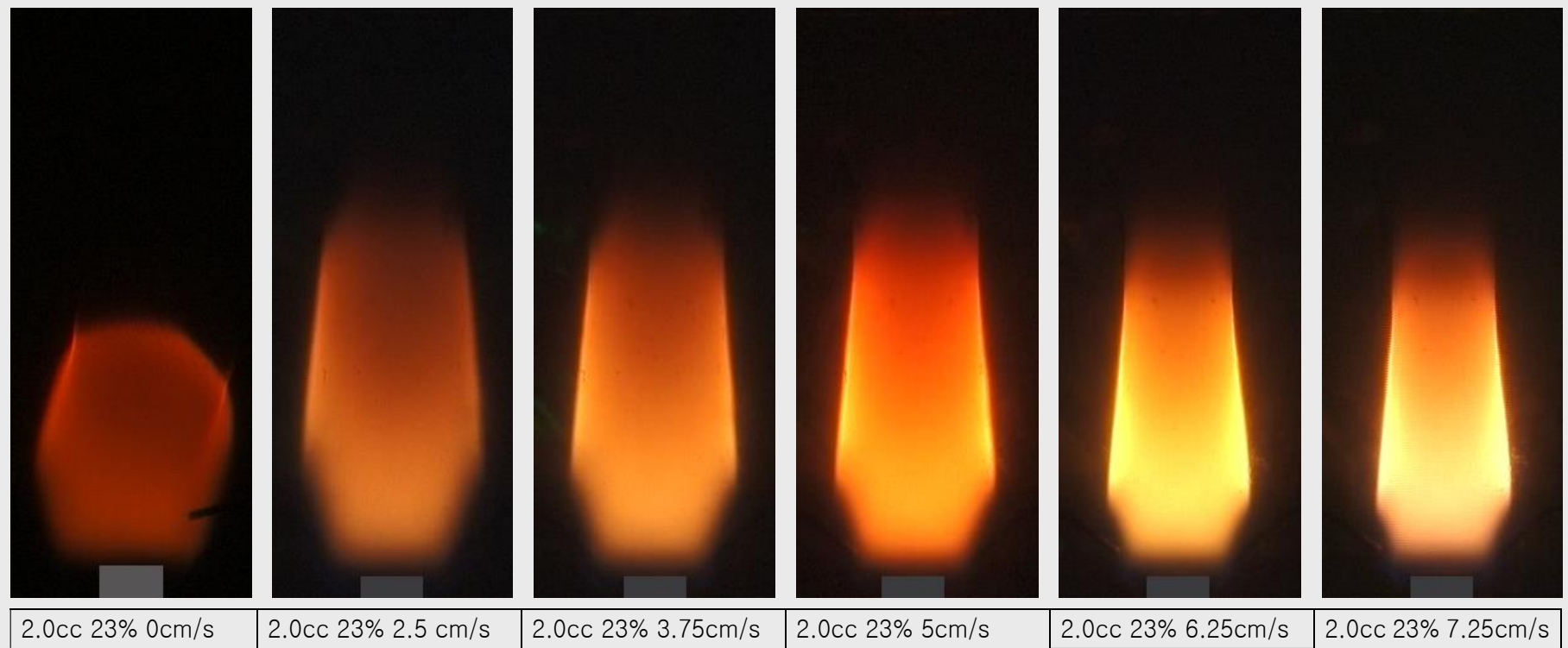


**Numerical simulation for
practical purpose**

Example

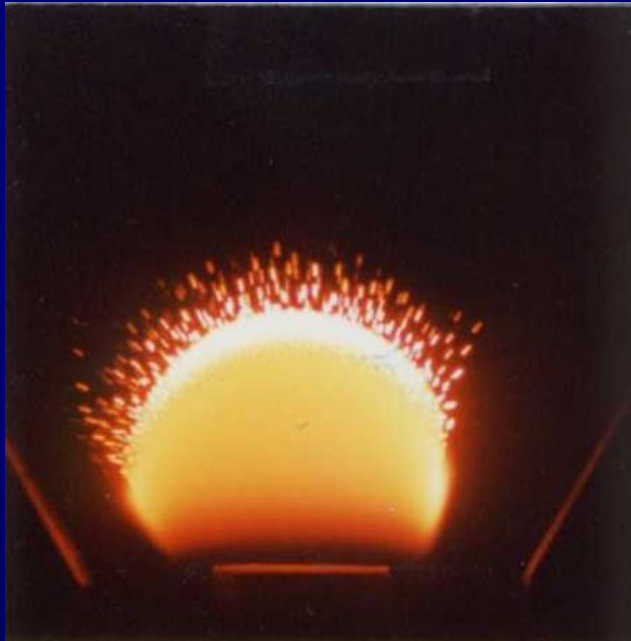
Effect of external flow on jet diffusion flame

*2.0ml/s O₂23%



Why Microgravity? (2)

-Place of New Findings-



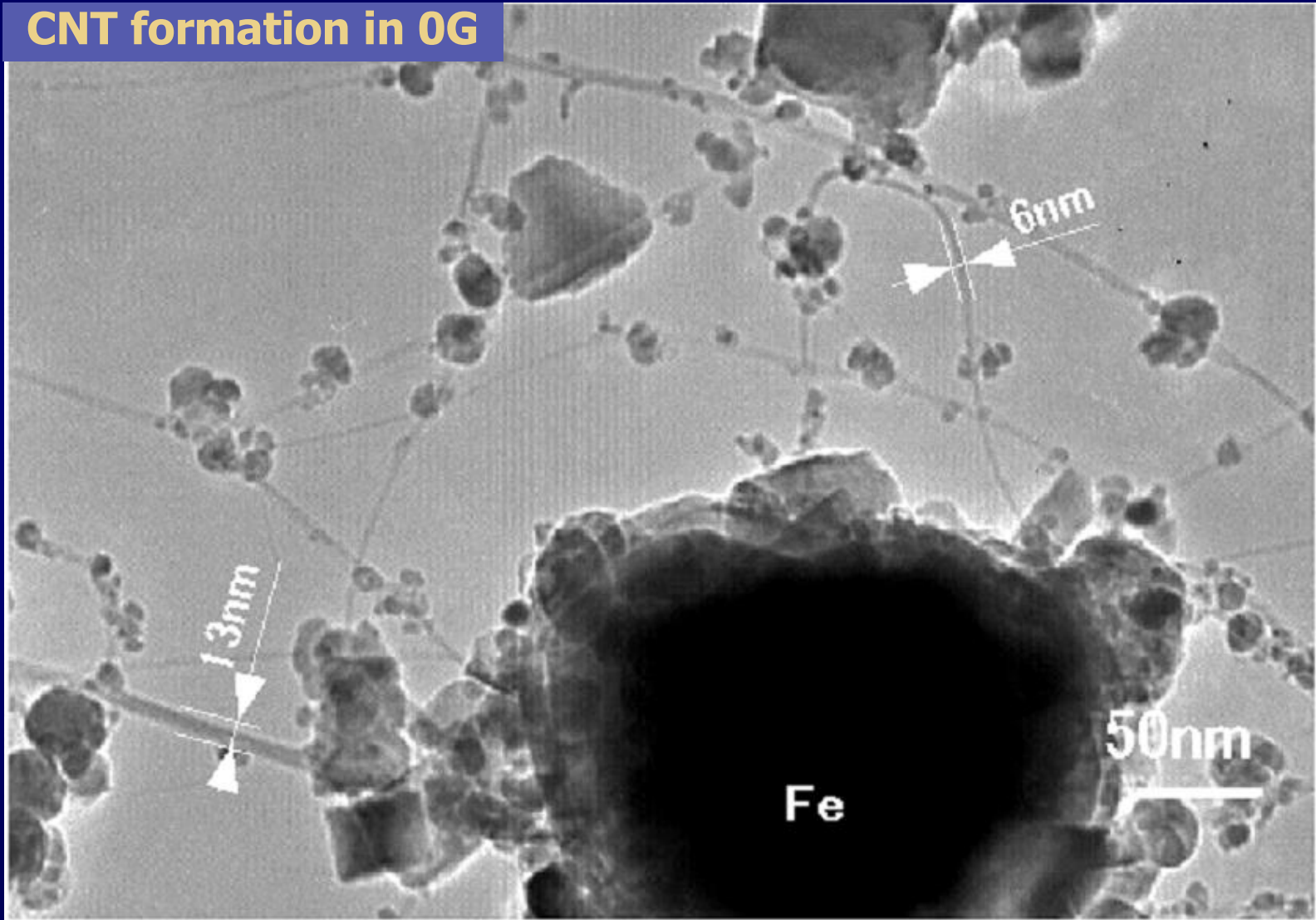
Ito H., Fujita O., Ito K.,
Comb. Flame 1994, 1996

1 G to μG = Paradime shift
→ Place of new findings

Why Microgravity? (3)

-Material Production-

CNT formation in 0G



Why Microgravity? (4)

-for Future Space Activities-



μ G Experiments

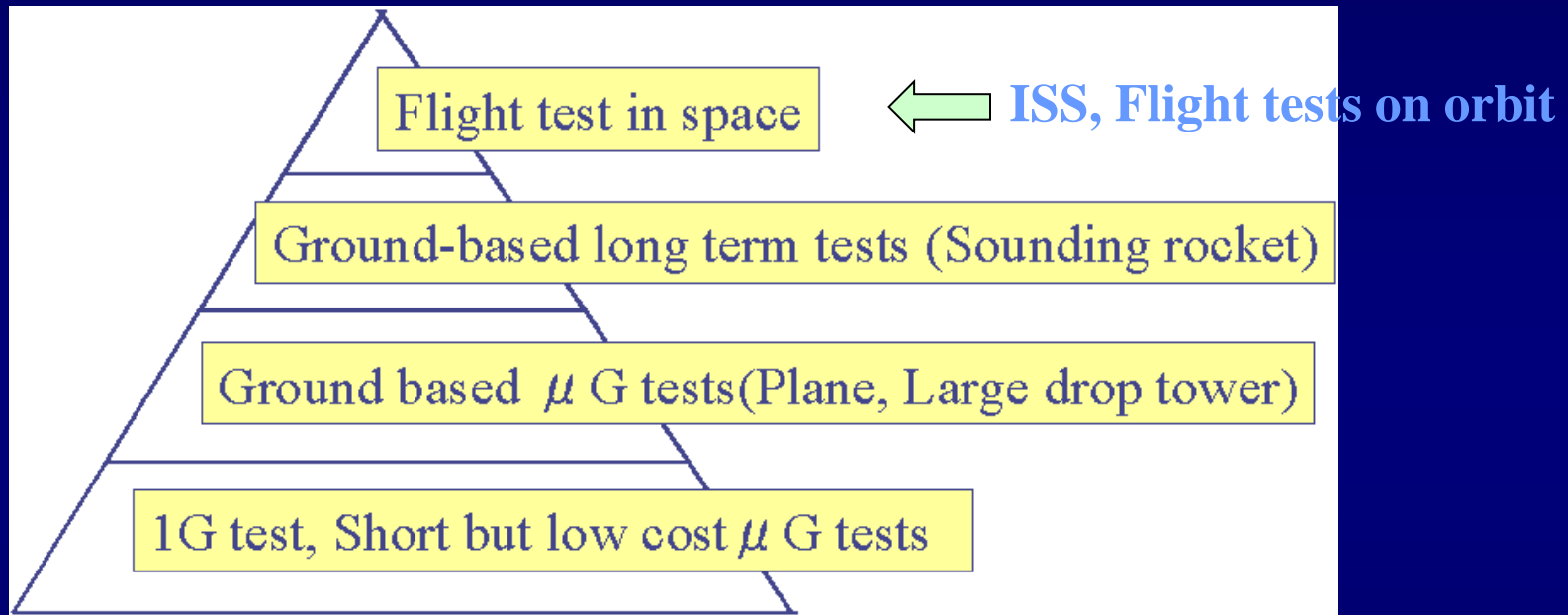


Preparation for
long-term manned
mission in space
(Life support in space,
Food and energy, Safety,
Adaptation of human being
to space, Technology in
space, etc)

Contents

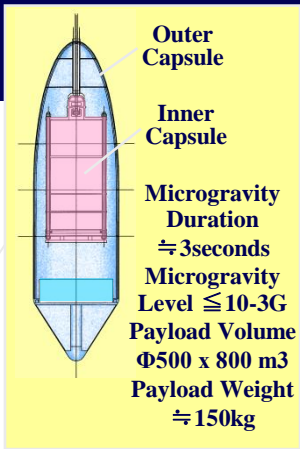
- 1. Why Microgravity?**
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Cascade of microgravity experiments



- Cost of second floor or above is not small for broad researches
- Attractive subjects affordable to higher cost are brought out from trials of many researchers.
- However, individual trial is not always affordable for each cost.
- Requirement of facility to take the role of first floor, which has not been covered previously, but essential.

3 sec Drop Facility



赤平で無重力実験

北大
50^{ドル}塔、月内着工

北海道新聞

2004年
11月12日 金

[illegible]

2004.11
北海道新聞



HASTIC 50m Drop Tower

COSMOTORRE コスモトーレ

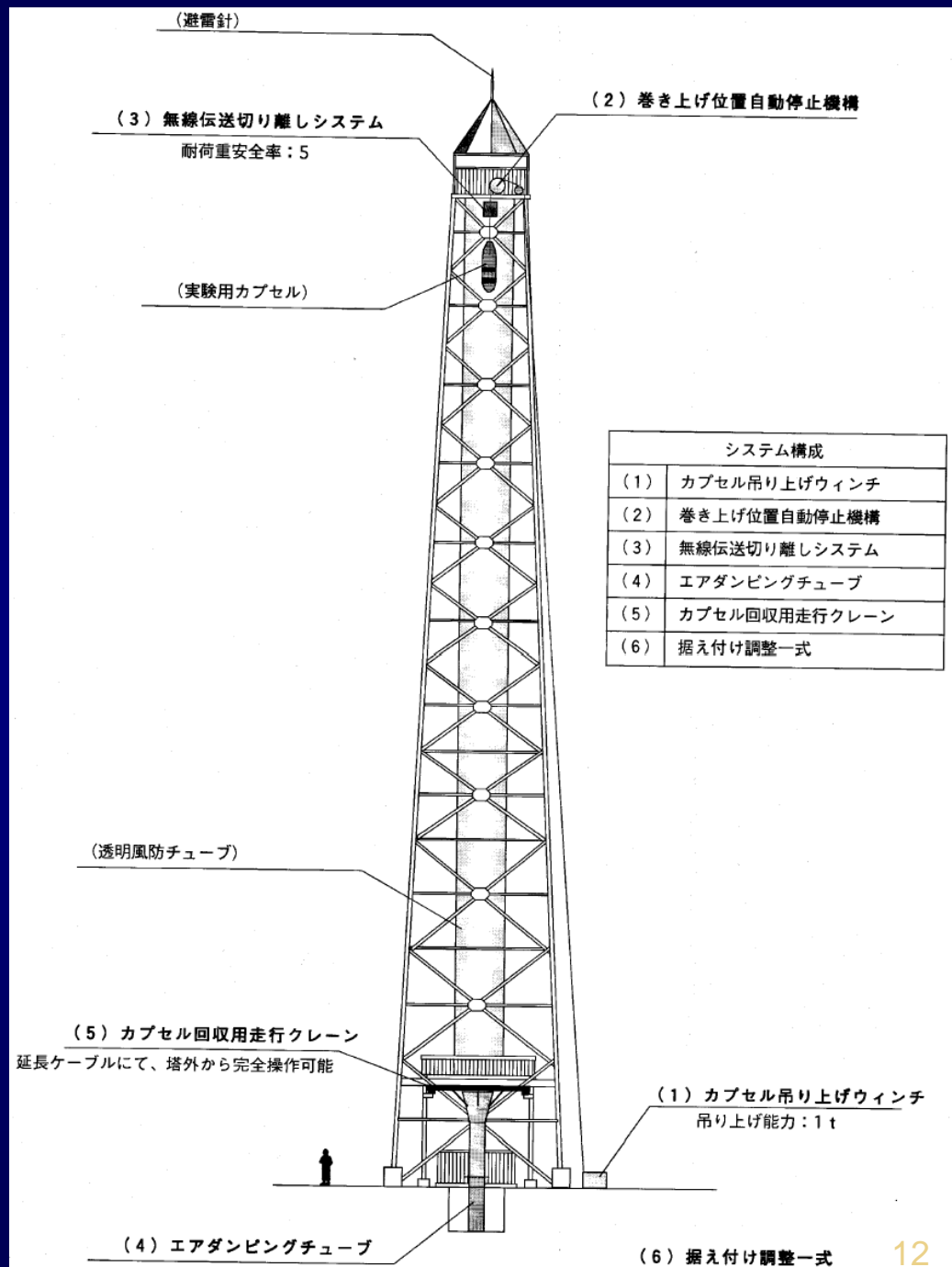


Items	Specifications
μ G time	2.5 sec (45mdrop)
G-quality	$> 1 \cdot 10^{-3} G_0$
Payload size	$\Phi 50\text{cm} \times 105\text{cm}$
Total weight	400 kg
Capsule type	With inner capsule

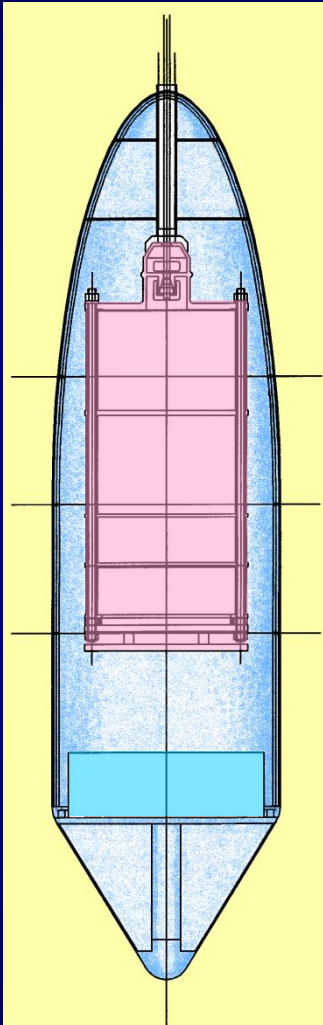
Structure of the drop tower

Height 50m

Free fall length 40m



Drop capsule and payload rack



**Drop Capsule
with inner rack**

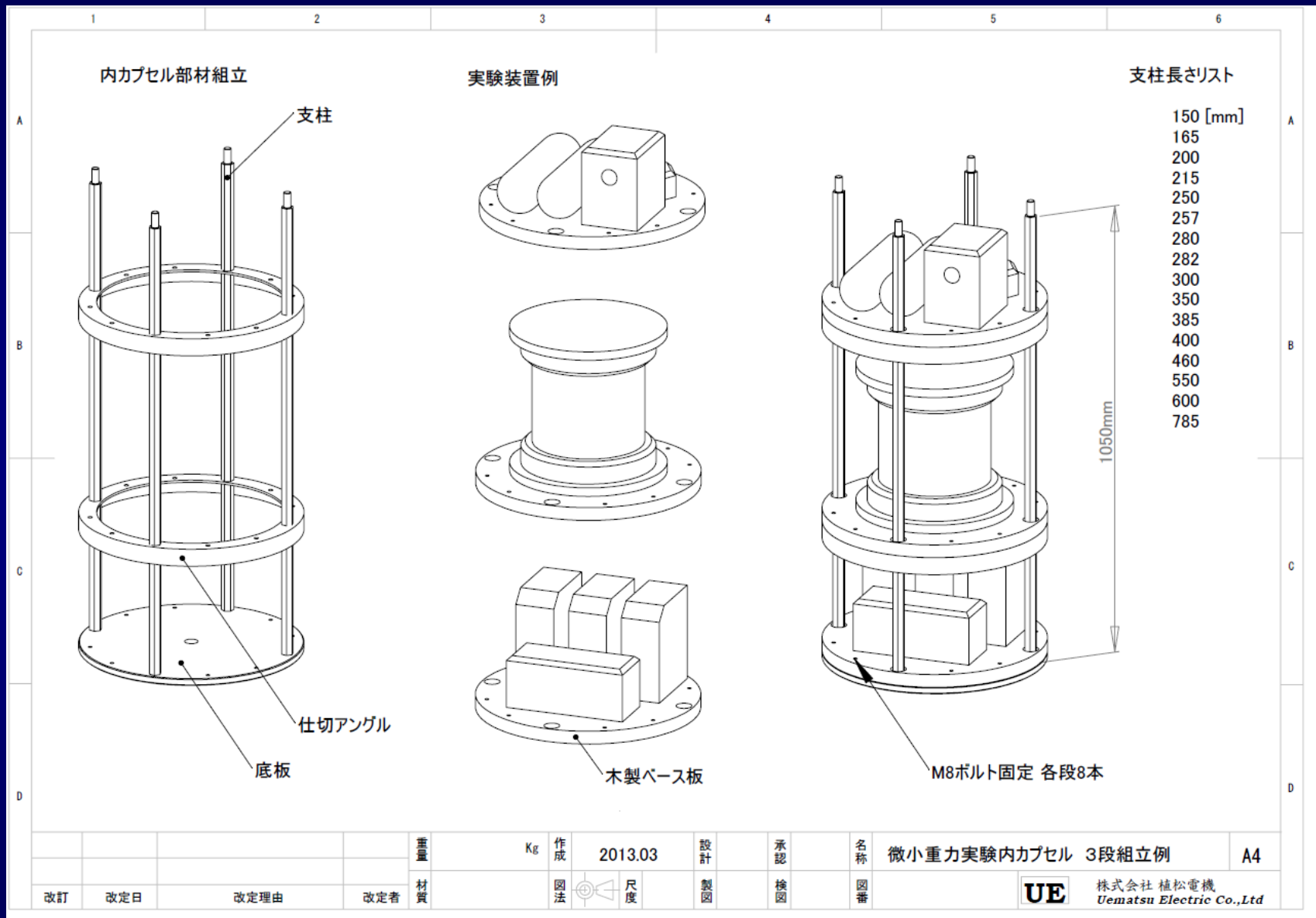


Inner Rack $\phi 50 \times 105\text{cm}$



Capsule with inner payload

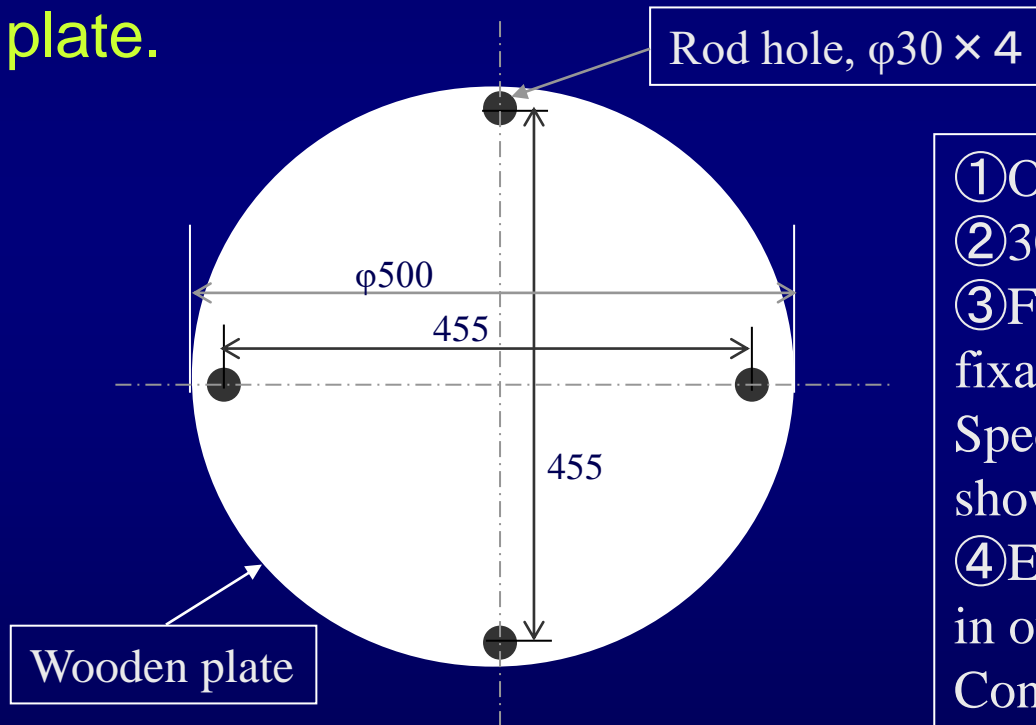
Example of inner capsule assembling



Available space of inner capsule is 50cm(diameter) × 105cm (high), The space can be used separately as in the above figure. Each equipment is set on a wooden base plate (see next page).

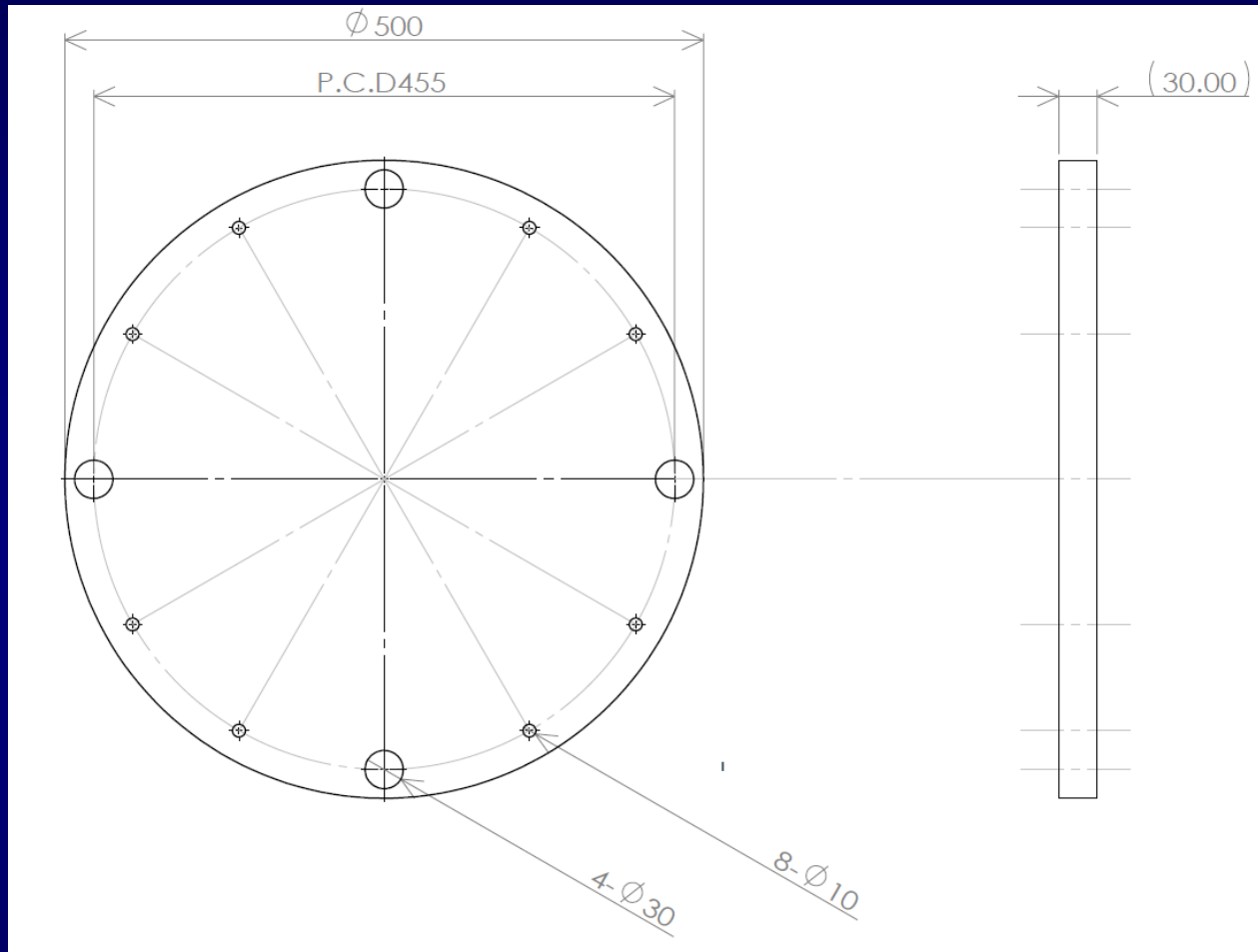
Base plate to be self-prepared by user

Please prepare the wooden circular plate as below and put all of experimental set up on the plate.



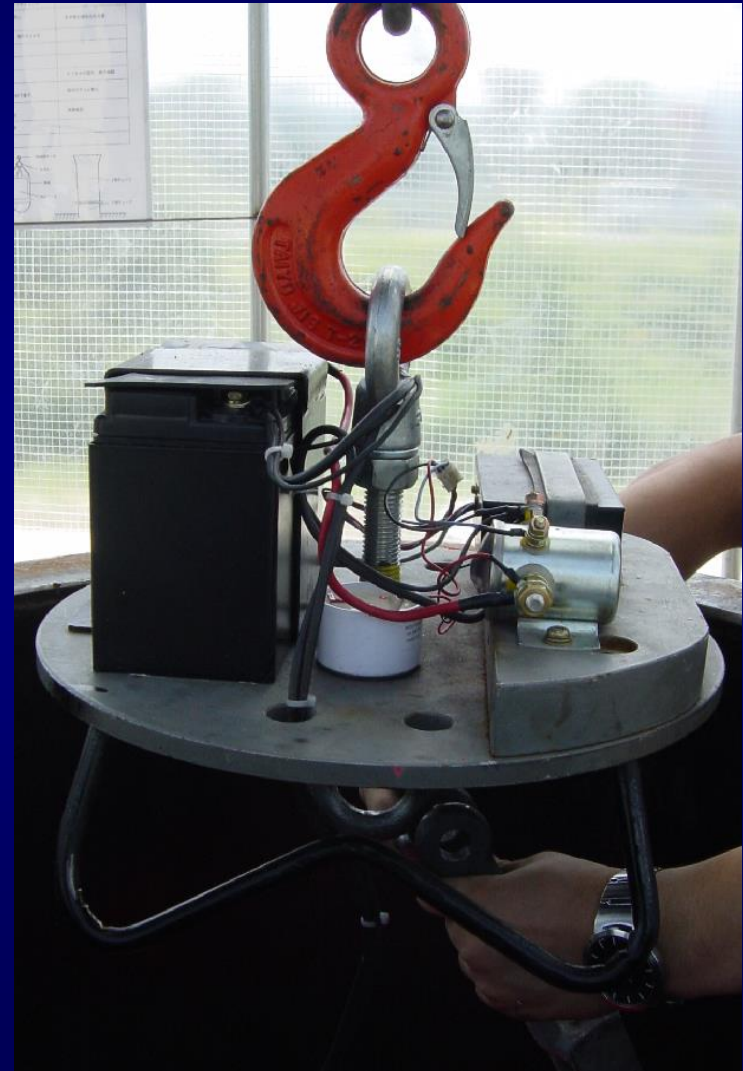
- ① Outer diameter $\phi 500$
- ② 30mm thick wood plate
- ③ Four rod holes ($\phi 30$), eight fixation holes ($\phi 10$) are needed. Specific position of holes are shown in the next page.
- ④ Experimental set up should be in outer circle of the plate. Consider the interference with suspension rods.

Specific position of holes

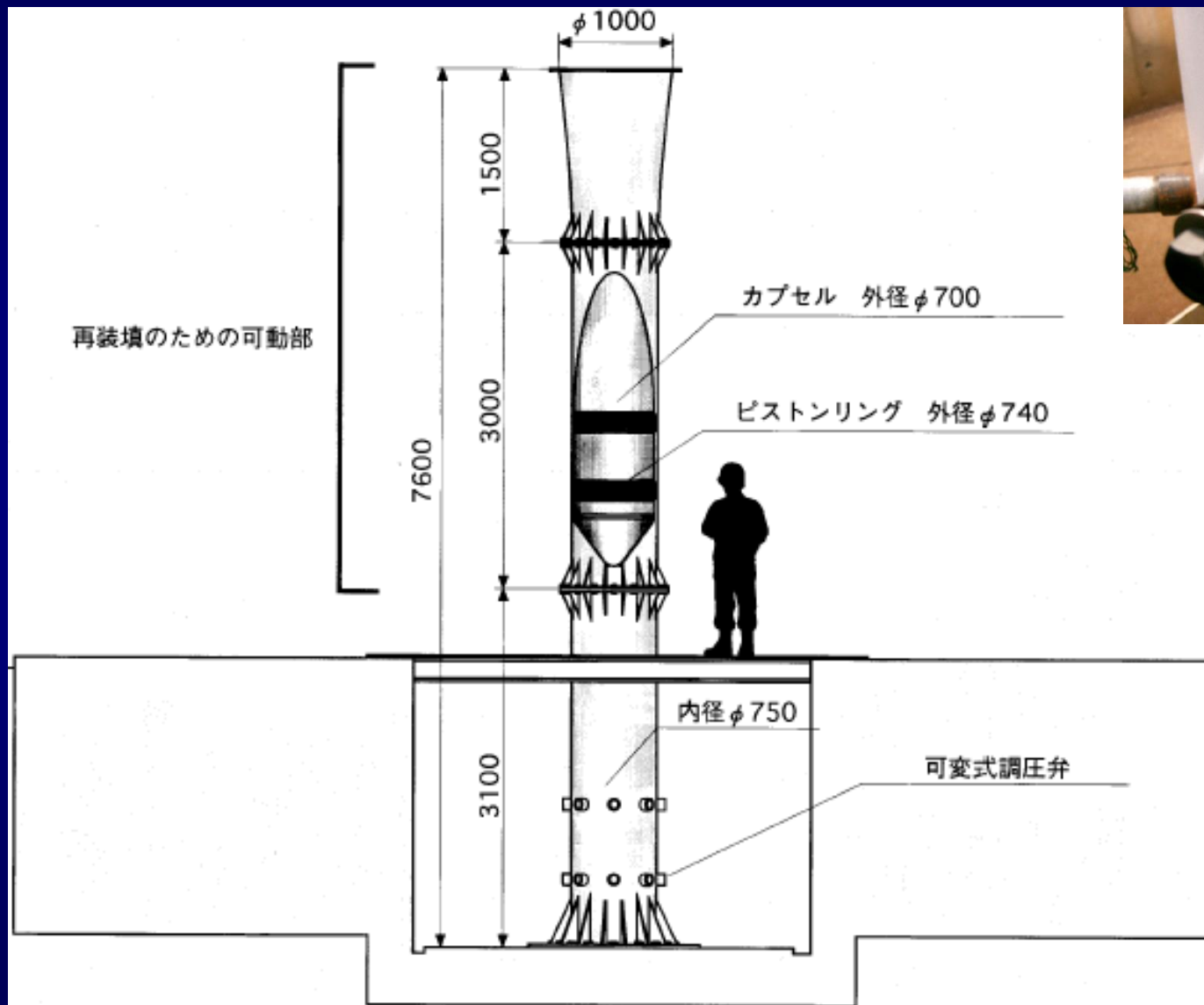


- ① 4 holes of 30mm for suspension rod at the position in the figure above.
- ② 8 holes of 10mm as M8 bolt clearance holes as in the figure above.
- ③ Consider interference with suspension rods and M8 bolt heads.

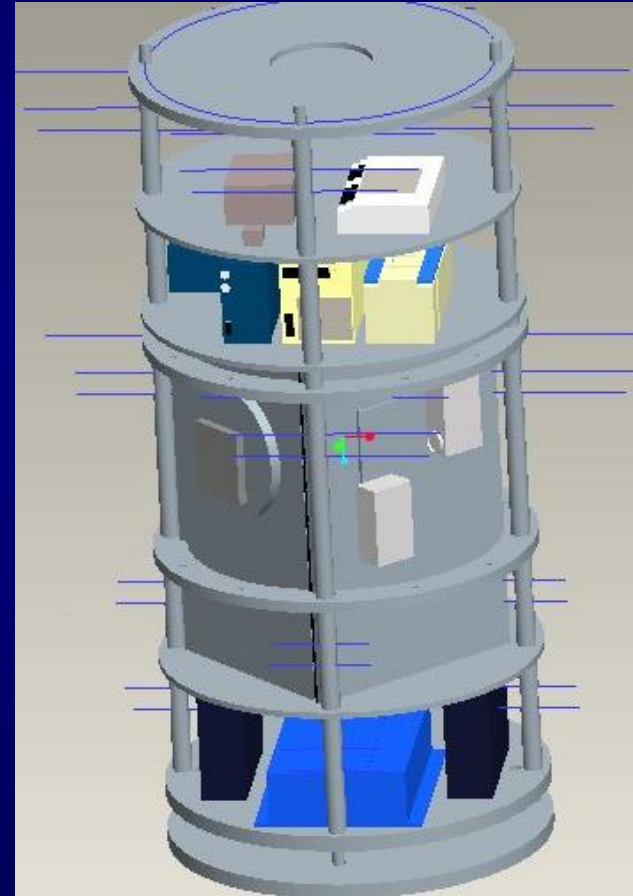
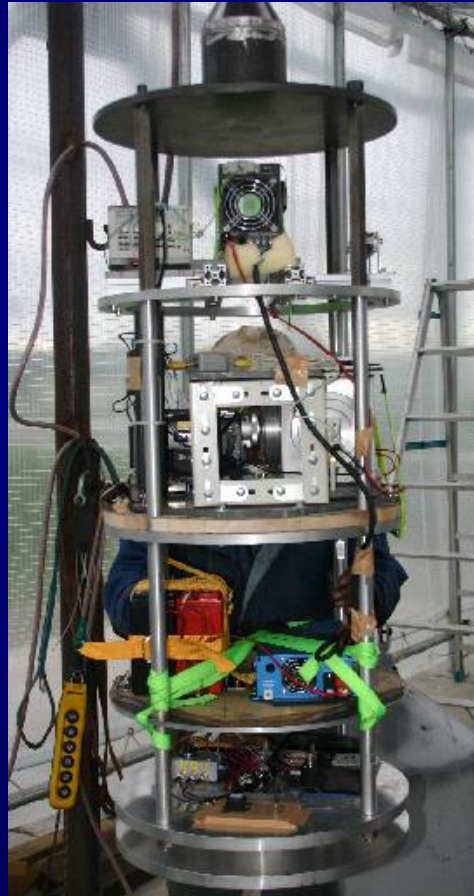
Capsule release system



Breaking system



Examples of experimental setup



Capsule preparation (1)



Capsule preparation (2)



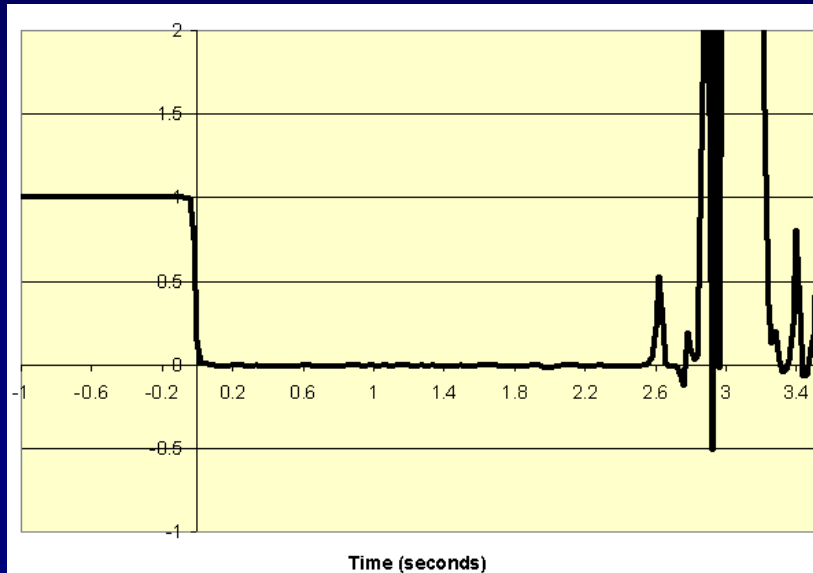
Capsule preparation (3)



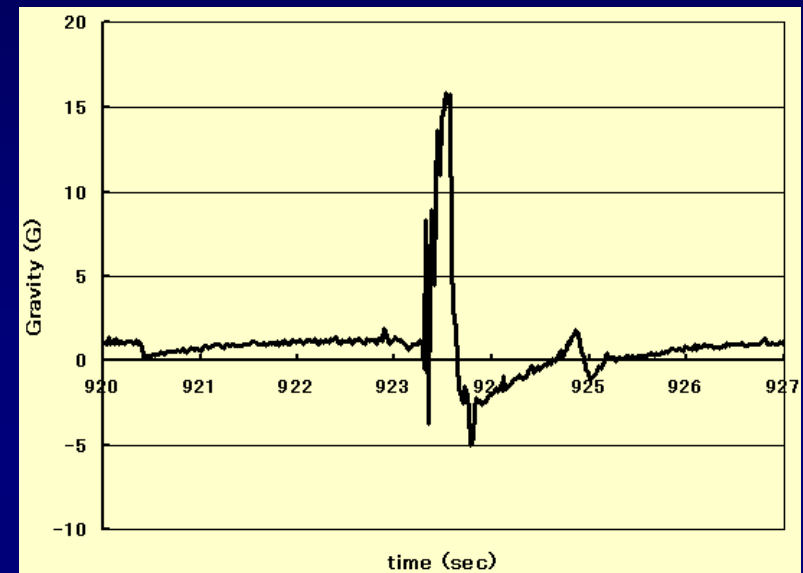
Bottom View of Drop Tower



Gravity data



Microgravity data

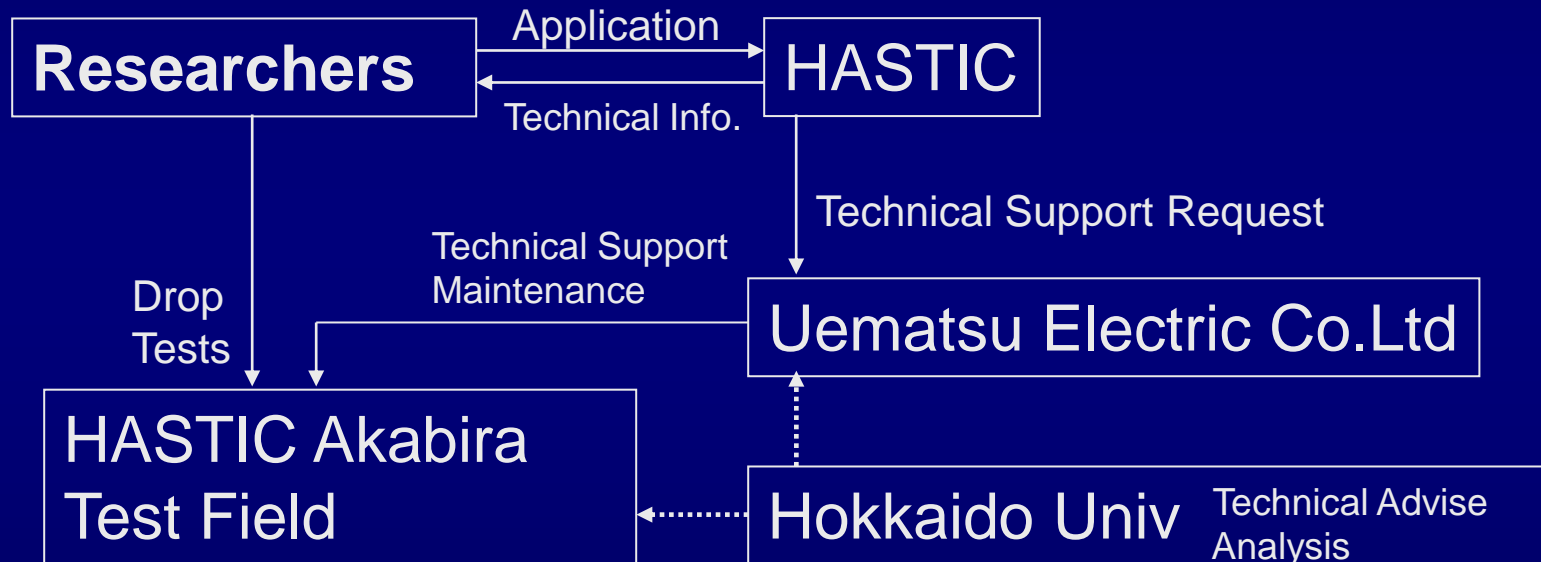


Moment of break

Payload : MAX 100kg (TBD)
Dimension of Payload : $\phi 50\text{cm} \times 105\text{cm}$ high
Power resource : User (TBD)
MicorG : 10-3G or less
MicroG time : 2.5-2.8 sec
Impact : 20G or less

Open for any researchers and educators

- To incubate future subject for higher level facilities
- To grow up next generation people



<http://www.hastic.jp/>

email: office@hastic.jp

Logo and Nickname

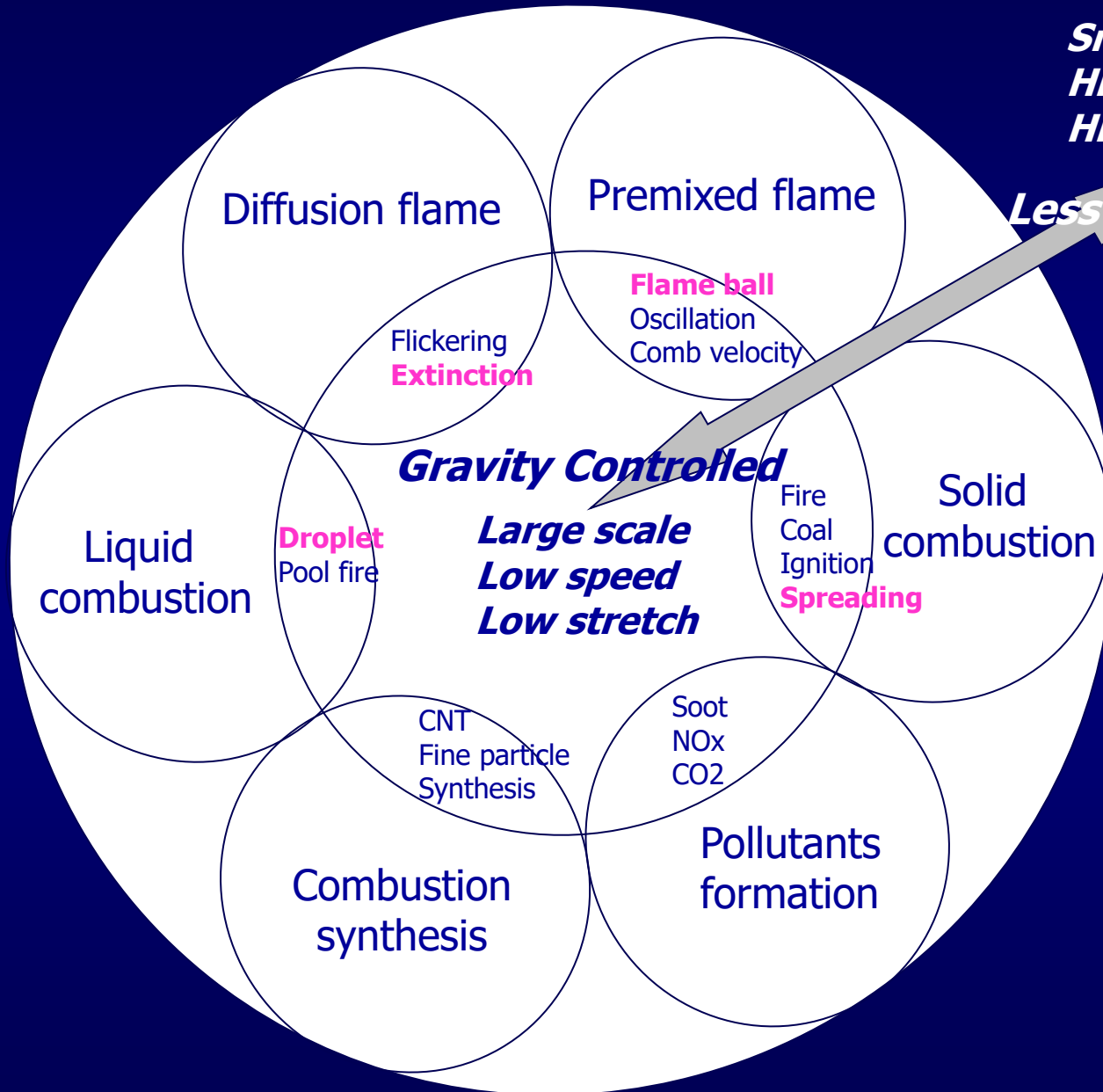


Nickname : from 533
Logo : from 81 proposals

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Research Area of Combustion Science



Small scale
High speed
High stretch

Less Gravity Effect

$$Gr = L^3 g \beta (T - T_0) / \nu^2$$

$$Fr = u^2 / gL$$

Some research topics are intensively studied, but many topics are still remained.

In the remained part, subjects related to urgent important topics on the ground are involved.

Example of research projects (combustion research)

- **Fire safety**
- **Material synthesis**
- **Flame instability**
- **Properties on combustion**
(Flame speed, Flammable limit, etc)
- **Secondary force** (Thermophoresis, Electrophoresis, Magnetic effect, etc)
- **Diffusion control process** (Le effect)

Acknowledgement

For the construction of drop tower, Hokkaido University have supported from the companies, *Hokkaido Electric Power Co., Inc.*, *North Pacific Bank Ltd.*, *Ishikawajima-Harima Heavy Industries Co., Ltd.*, *Toshiba Co.*, *The Hokkaido Bank Ltd.*, *Japan Steel Works Ltd.*, *Toyo Engineering Co.*, *Hokkaido Gas Co., Ltd.*, *Mitsubishi Heavy Industries Ltd.*, *IHI Aerospace Engineering Co. Ltd.*



The researches introduced in the presentation are granted by AOs JSF ground based research, Grant-in-aid (Kiban (B) by JSPS.