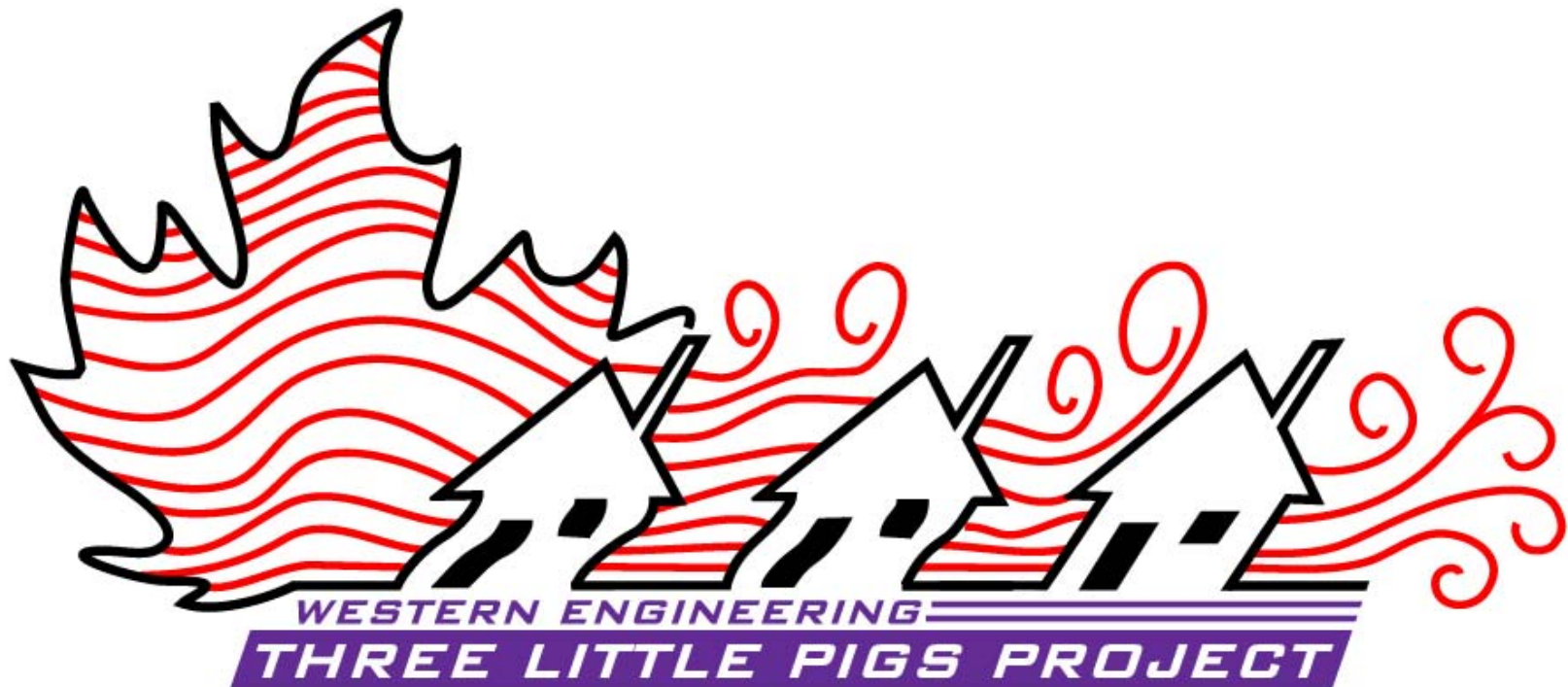


Hurricanes and Houses: Causes and Consequences

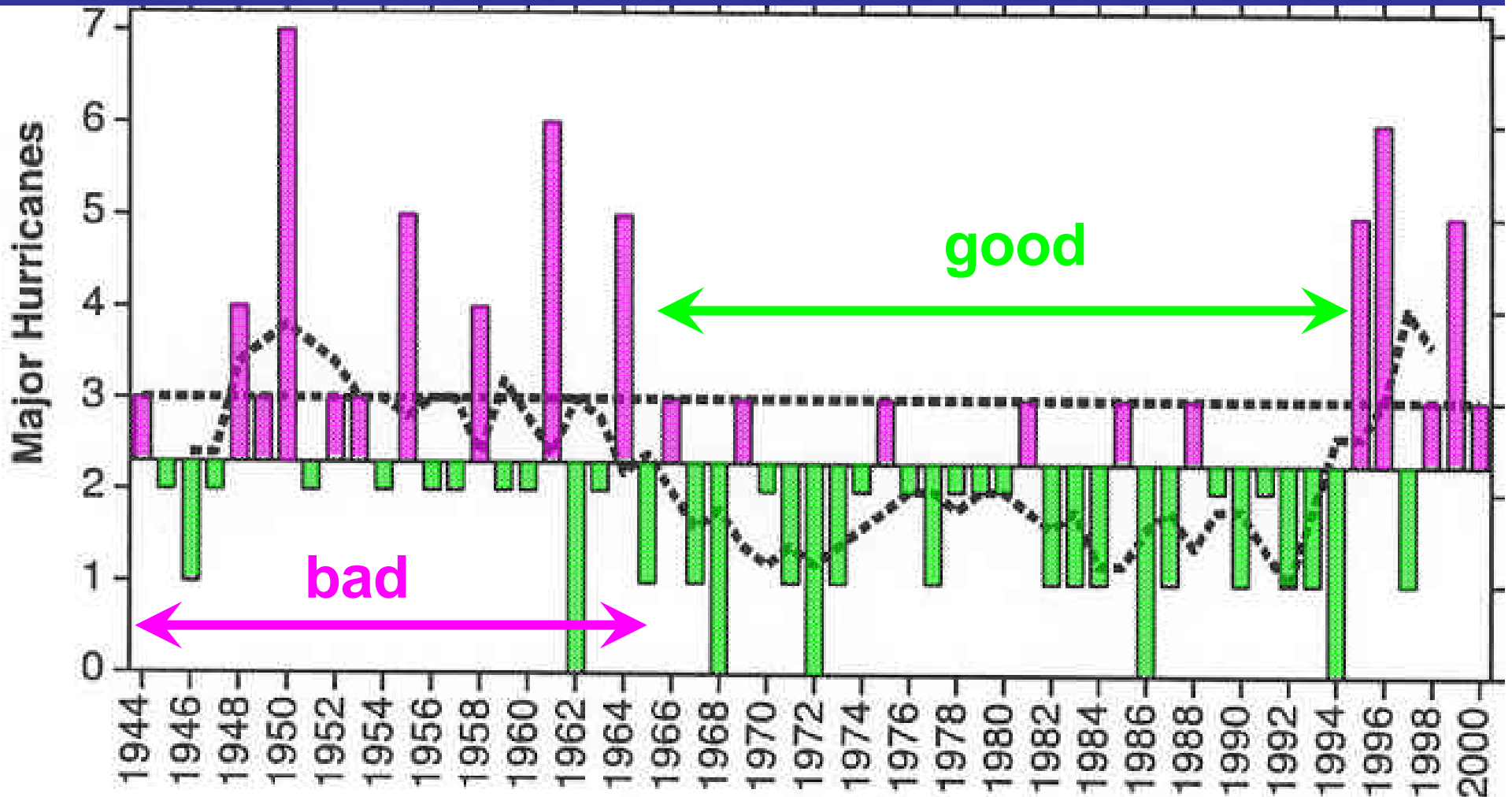


Mike Bartlett, Ph.D., P.Eng.
University of Western Ontario

Today's Itinerary

- **Hurricanes & their frequency**
- **Effects on houses**
- **Three Little Pigs Project**
 - **What we will learn**
 - **Status**

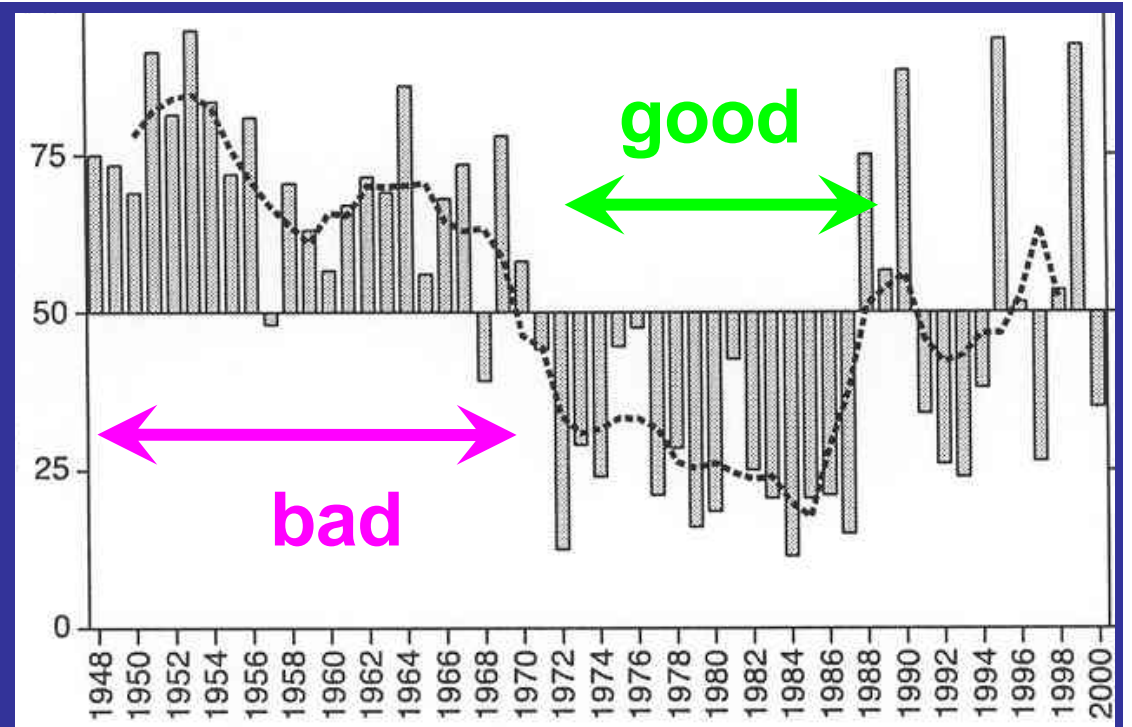
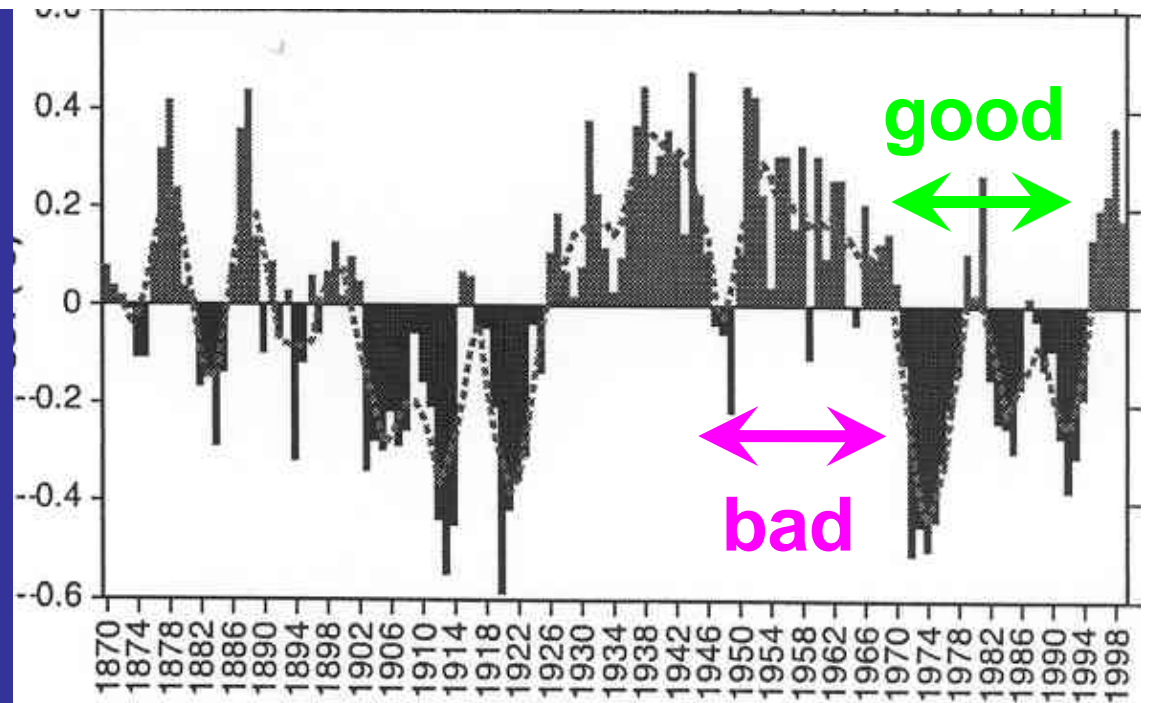
Atlantic Hurricane Activity Increasing

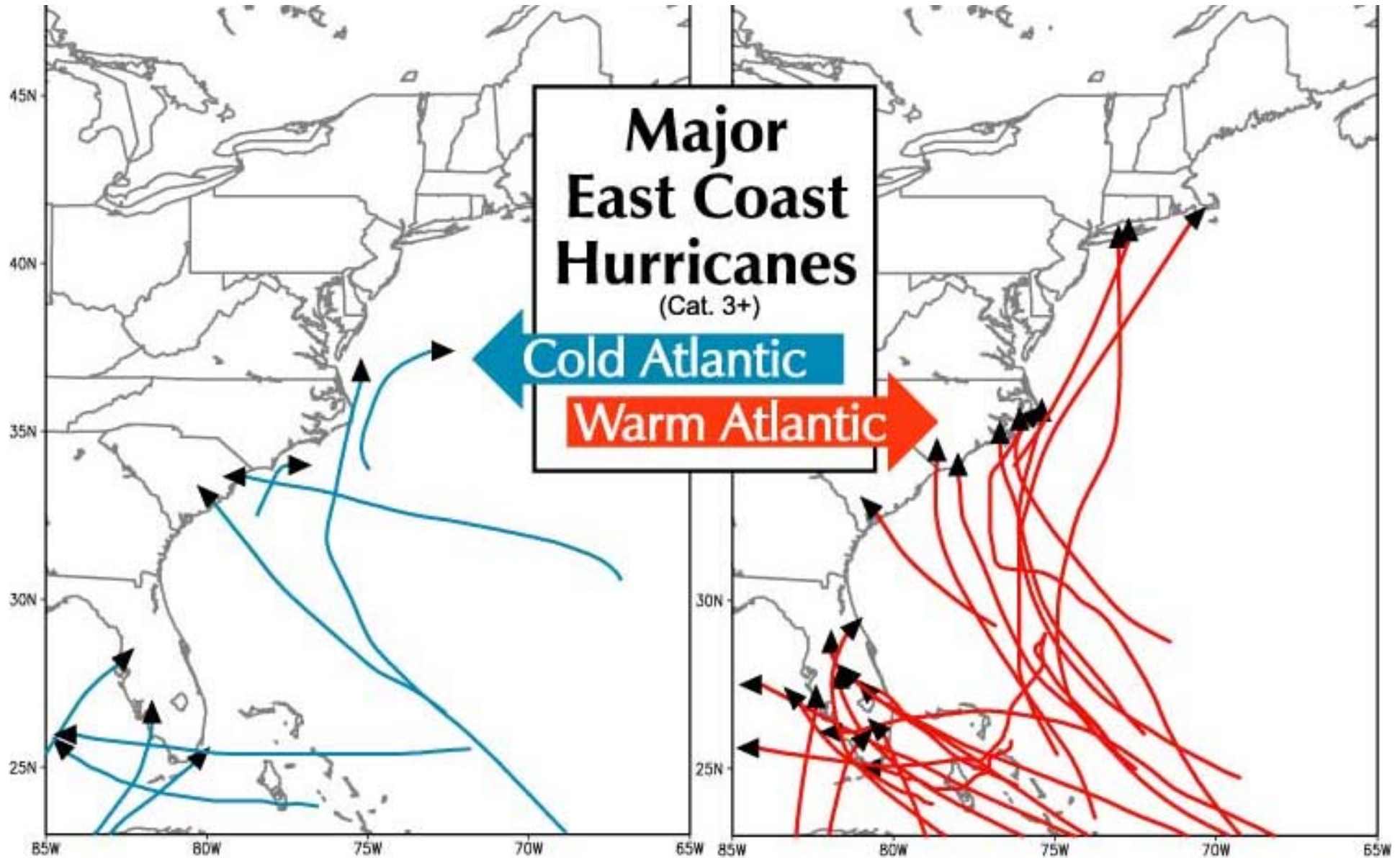


- Goldenberg et al, *Science* 2001

Linked to
Sea Surface
Temperature

and Vertical
Wind Shear





1903-1925, 1971-1994

1926-1970, 1995-2000



www.noaaneews.noaa.gov/



Goldenberg et al (2001) conclude:

- Effect of global warming?
“results inconclusive”
- “Present high level of hurricane activity likely to persist for an additional ~10-40 years”

Animation: Applied Research Associates & Blue Sky Foundation



Hurricane Hugo, North Carolina



Gable Roof Damaged

Hip Roof Undamaged



Cyclone Larry, Australia, 2006



Western's \$6.8 M “Three Little Pigs” Facility



full-scale tests of:

- **structural response**
- **moisture penetration/mould**

Multidisciplinary team at Western



Surry

Kopp

Galsworthy

Savory

El Damatty

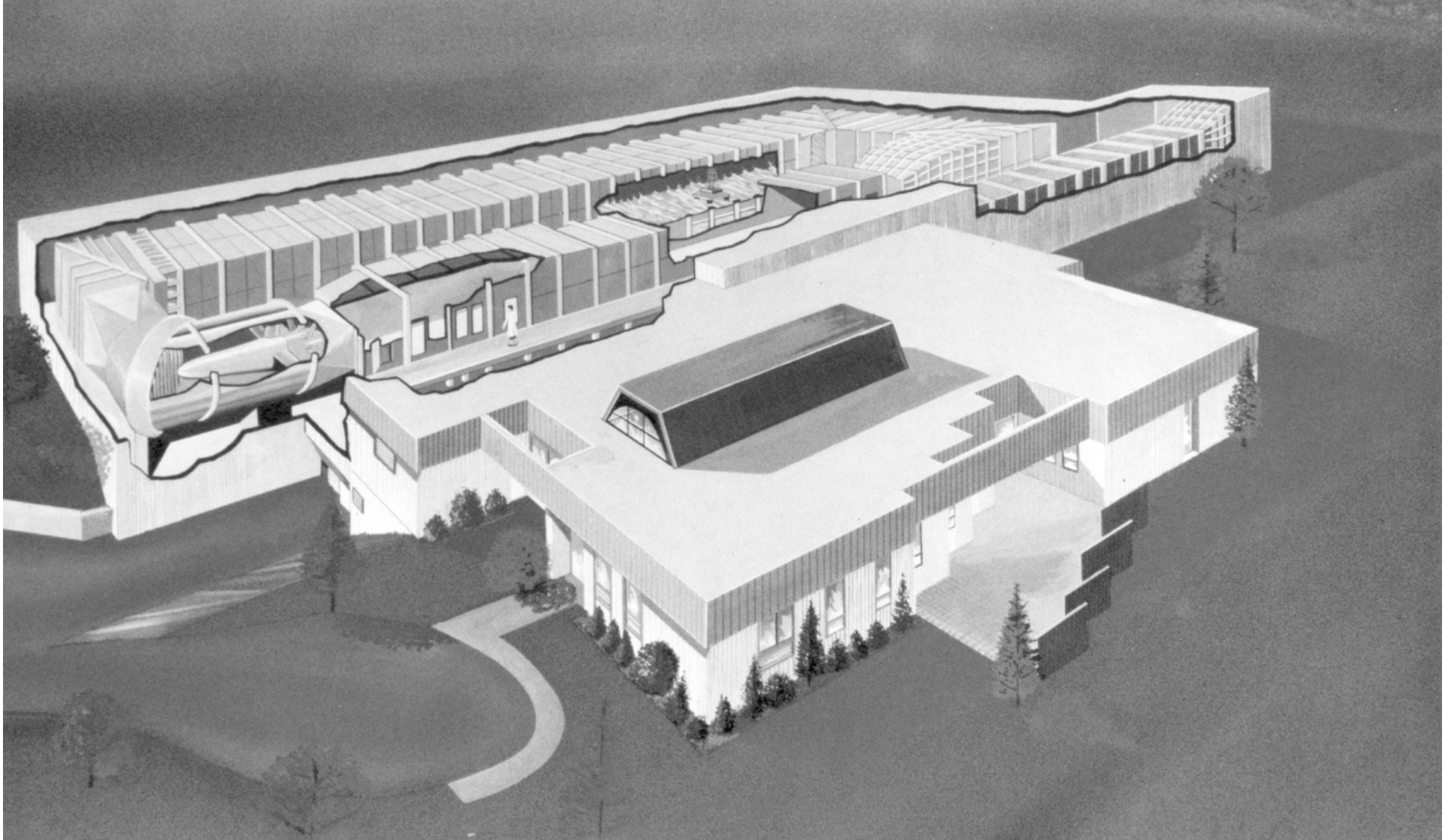
Bartlett

St Pierre

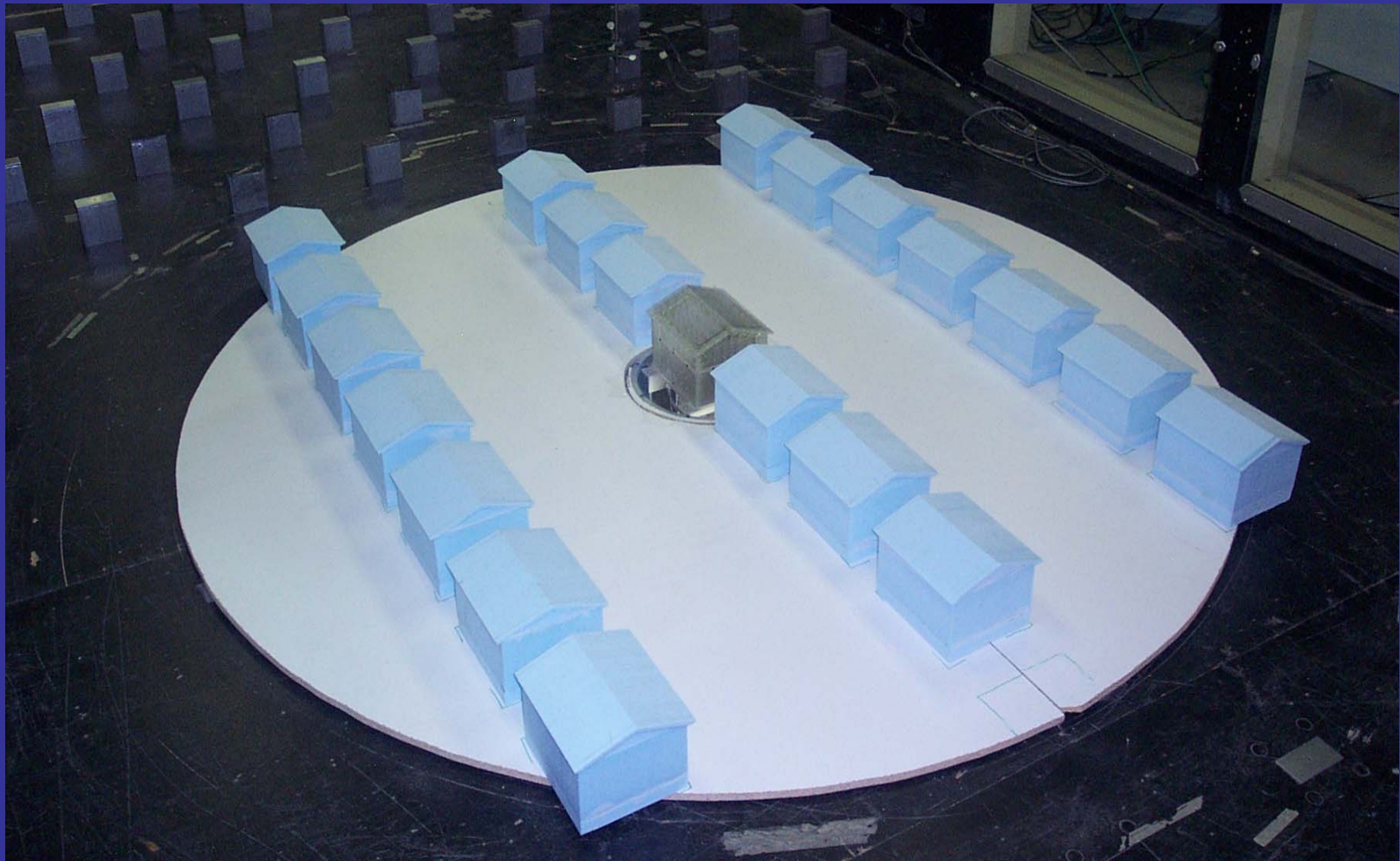
Hong

Inculet

Boundary Layer Wind Tunnel Laboratory



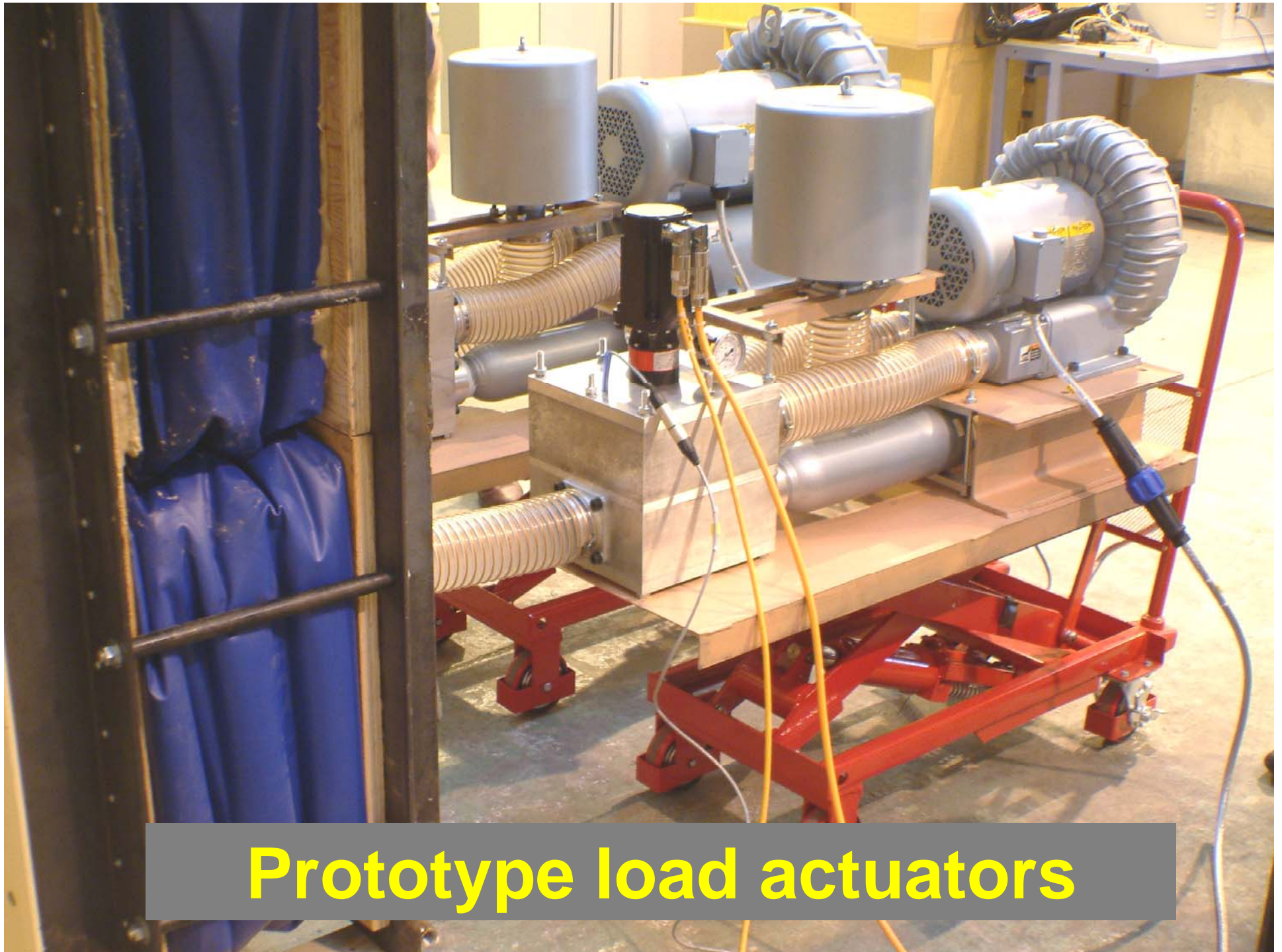
Model Tests in Various Terrains



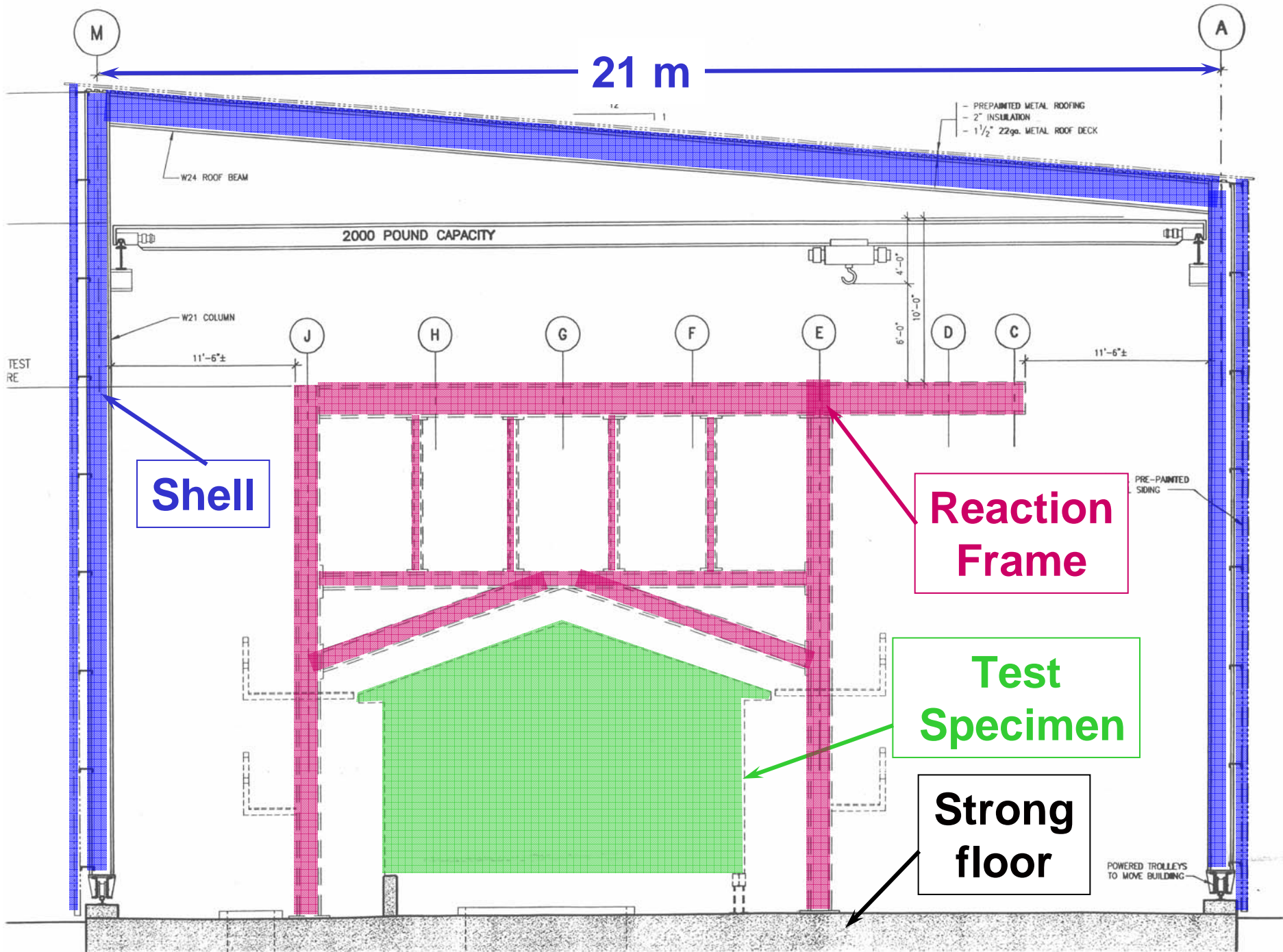
Subdivision, typical street and boulevard widths

Link to Three Little Pigs

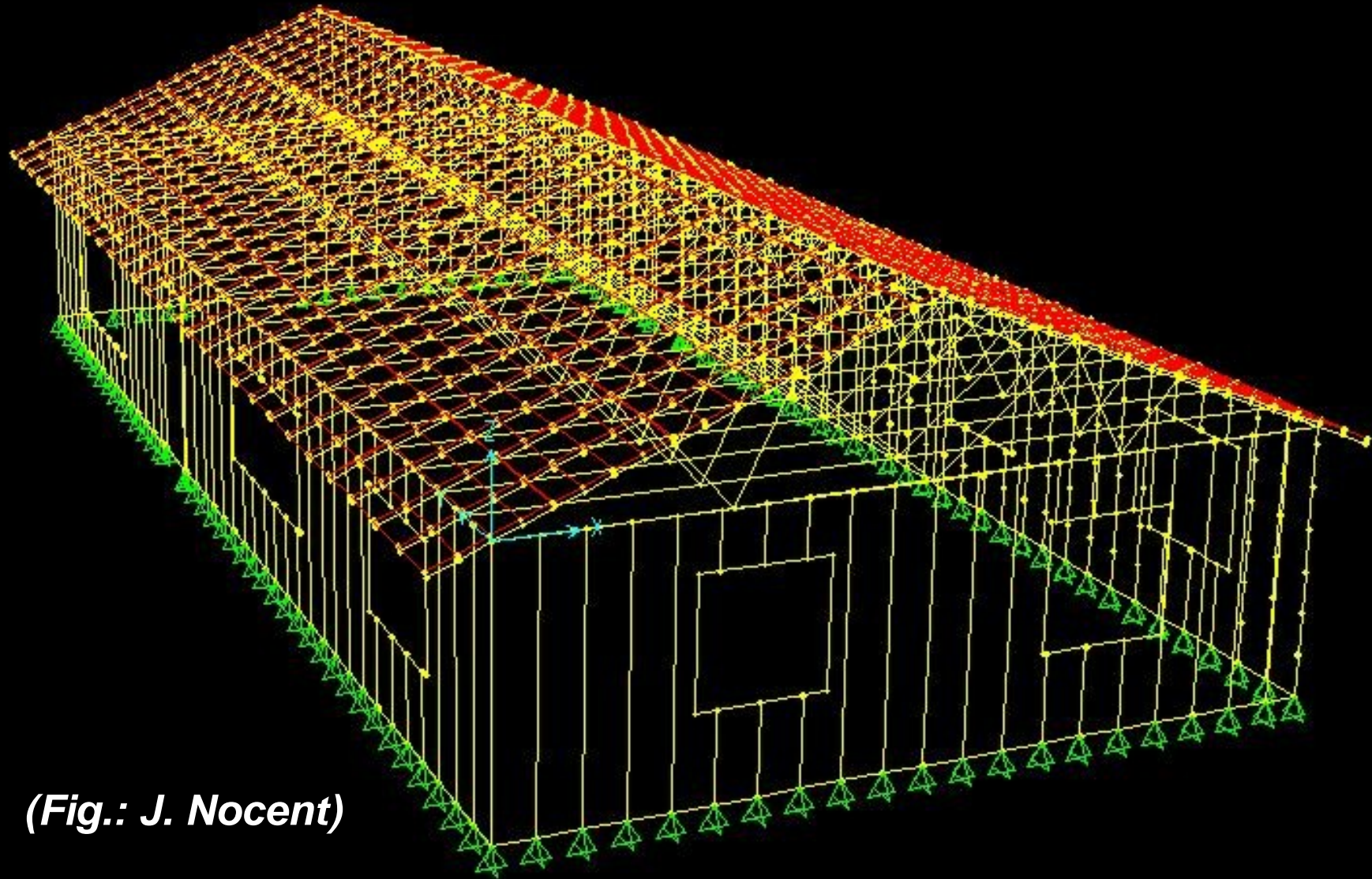
- Wind tunnel data will feed the 'Wolf'
- Pressure time-histories will be directly applied to the full scale test house
- **Engineer** turbulent wind that can be reproduced



Prototype load actuators



Validate computer load path analyses



(Fig.: J. Nocent)

MoU with Fanshawe College

- Hands-on construction
- Long-term research collaboration

Fanshawe students framing floor



Better homes & home owners

- 1. Move prescriptive building codes (now based on past practice) to become based on scientific evidence & sound engineering principles**
- 2. Improve design & installation of dwellings & building materials in partnership with builders and manufacturers**
- 3. Educate the public on safety issues**

Complimentary Studies

- **Human error and quality control in construction**
- **Moisture in the building envelope**
- **Conditions for mould growth**

Studioswords
TM

CChubb REVISION

05 12/01 09:44:55

05 12/01 09:44:56

05 12/01 09:44:55

05 12/01 09:44:56

Operator: OPERATOR 2005-12-01 09:44:54

DISPLAY

RECORD

RECORD ALL

UTILITY PLAYBACK

PTZ FULL SCR

LOG OFF EXIT

**Video monitoring
from Control Building**

Real-world Defects

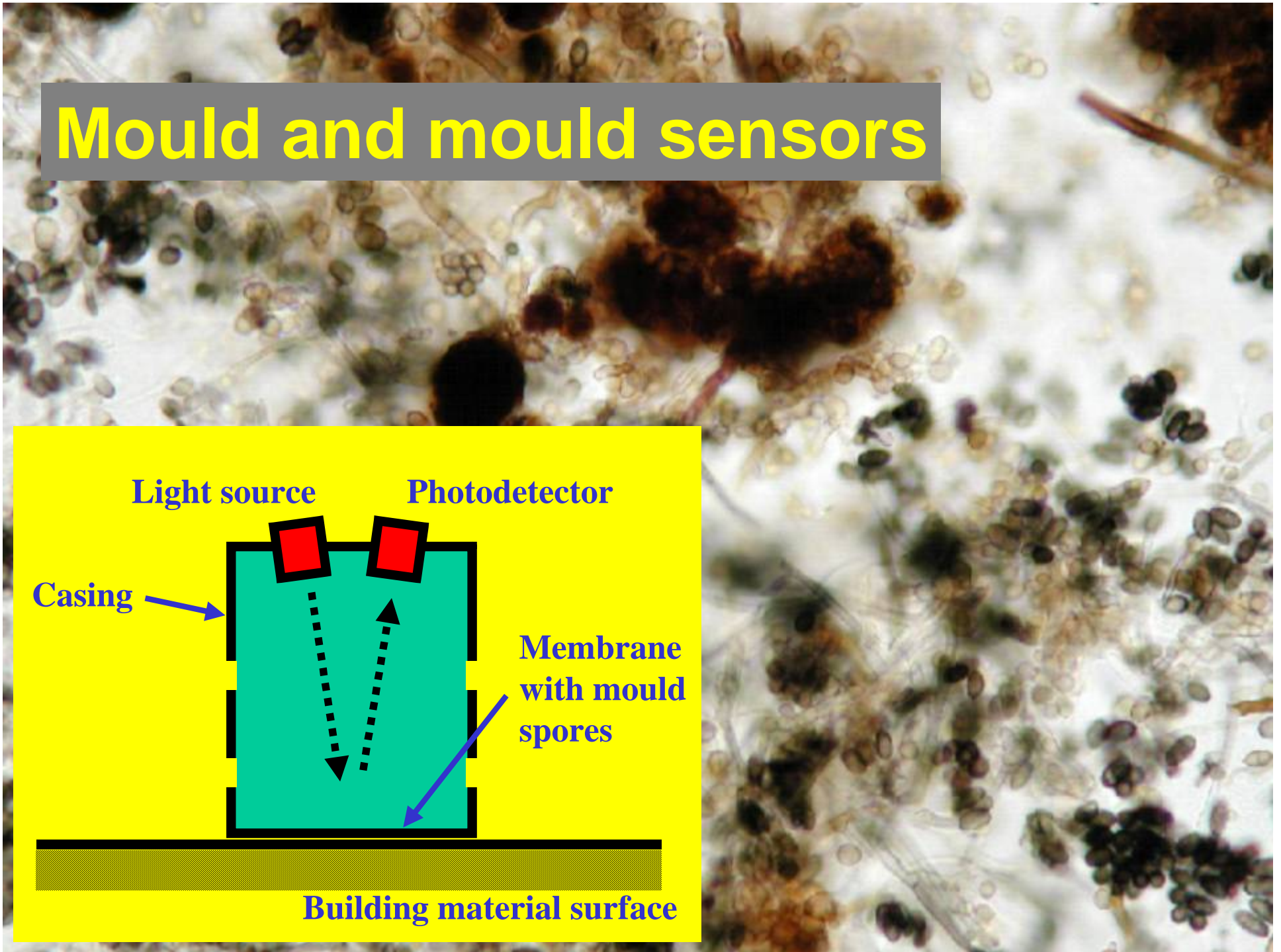
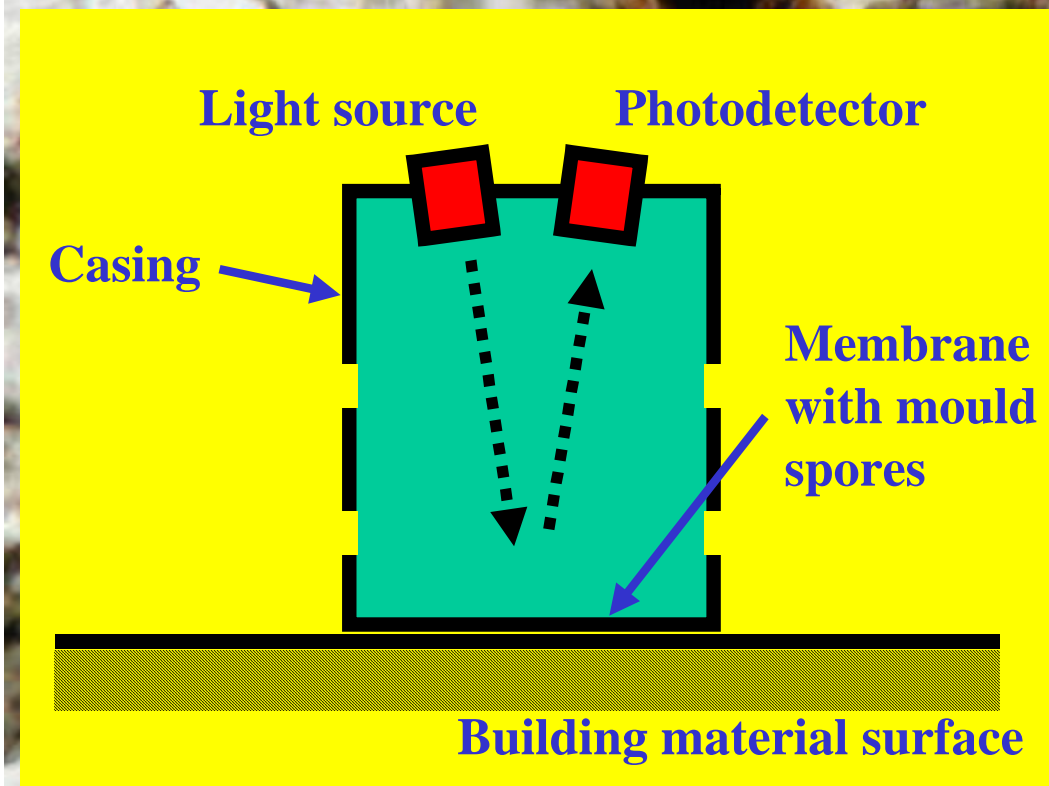


“The frame was
in the way!”



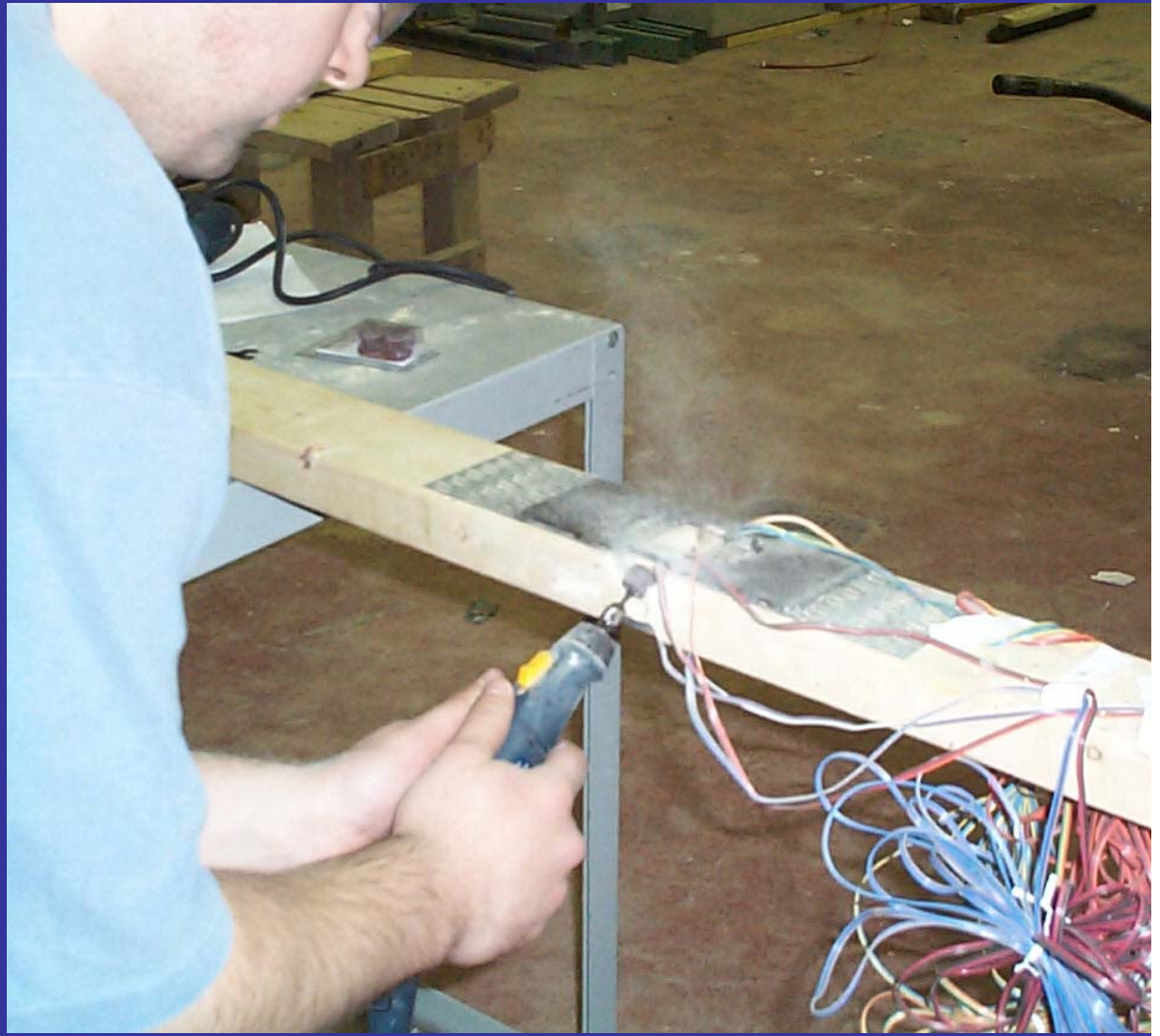
Control Building test wall panels for mould and moisture penetration studies

Mould and mould sensors



Immersing students in disaster and disaster-mitigation research

Jeff Nocent
completing
load cell
installation in
2x4 truss
chord

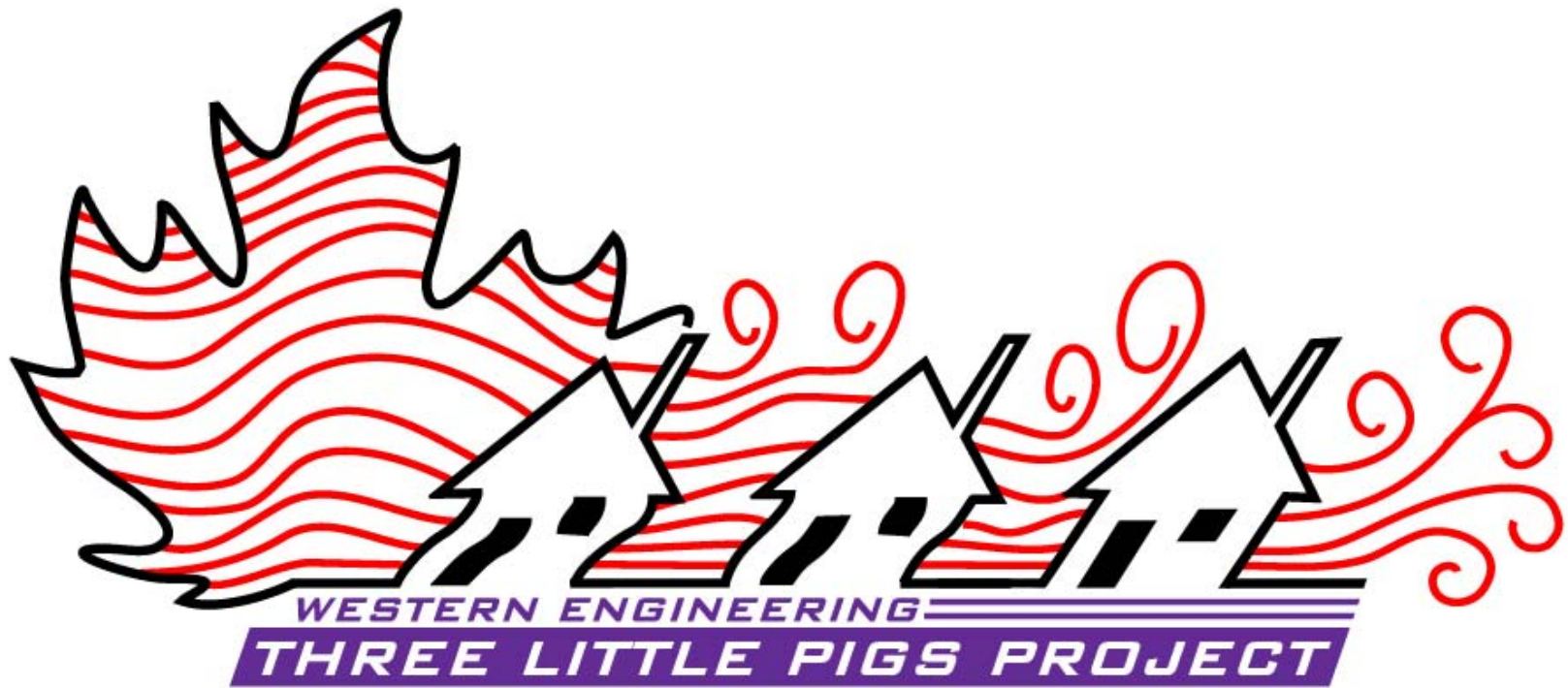




At a full-scale world-class facility

In closing...

- Atlantic hurricanes will be more frequent
- Significant impact on light-frame construction
- Three Little Pigs project will provide **scientific evidence** from which robust houses can be **engineered**



www.eng.uwo.ca/research/ttlpp

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