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IPRO 336 Project Plan

Developing Innovative Design Concepts for Airflow, Energy Sustainability & Fire Protection Safety in Buildings

February 16, 2007

IPRO 336 It takes a team INTERPROFESSIONAL PROJECTS PROGRAM

Objectives

IPRO 336's objective is performing an original experimental study that will help to determine the effects that stack effect phenomenon has on the distribution of the pressure and the airflow movements within high rise buildings. Specifically, the effect that phenomenon has a on the movement of the fume (in case of fire) and pollutant gases, which are directly related to the safety of the inhabitants.

As a part of this project, the team is planning to:

- Quantify the effect of pressure variation due to stack effect on airflow diffusers
- Characterize the airflow diffuser
- Perform the air-tightness measurement of the building envelope
- Measure the airflow, pressure difference, temperature, relative humidity and air velocity in order to determine the thermal comfort indices (PMV, PPD and others)
- Deliver a descriptive report of effects that stack effect has in case of fire, and prescribe possible solutions

Background

Following nomenclature is established in order of achieving the understanding throughout the project:

a:	atmospheric pressure (psi), (Pa)
A:	opening area (free area of inlet opening, which equals area of outlet opening) (ft^2), (m^2)
C:	0.0342 (SI unit), C= 0.0188 (PI, U.S. customary units)
Cd:	discharge coefficient (usually taken to be from 0.65 to 0.70)
g:	gravitational acceleration, 9.807 m/s^2, 32.17 ft/s^2
Q:	flow rate induced by the stack effect (stack effect draft/draught flow rate), (cfm), (m^3/s)
Ti:	average inside temperature, (°R), (K)
To:	absolute temperature, outside, (°R), (K)
ΔP_s:	available pressure difference, (psi), (Pa)

Following paragraphs will provide background information on stack effect.
Stack or chimney pressure is caused by the difference in temperature (density difference) between the outside air and the air inside the building. This produces an imbalance which results in a vertical pressure difference. At the height of the neutral pressure plane the air pressure is equal at the exterior and interior of the building. Figure 1 illustrates this phenomenon, showing a negative pressure difference ΔP_s over the building envelope at the top (air is sucked out from the building), and a positive one at the bottom of the building (air is pressed into the building). That pressure difference ΔP_s is the driving force for the stack effect and it can be calculated with the equations presented below.

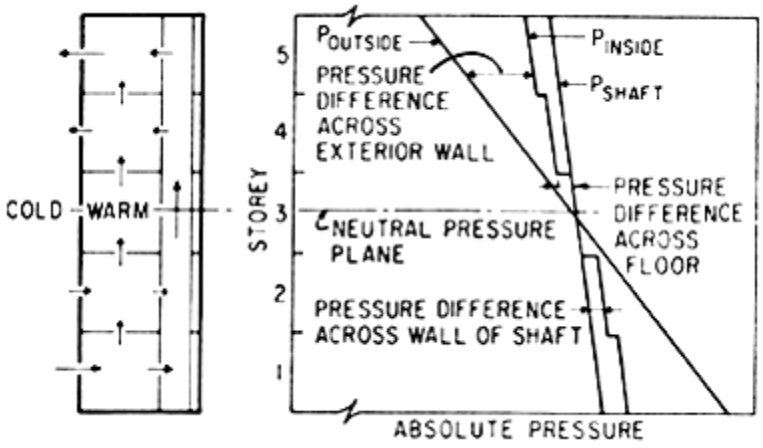


Figure 1: Stack pressure distribution on the two sides of the wall and the resulting pressure difference.

The pressure difference at the vertical distance z, in the downward direction, from the neutral pressure plane is:

$$\Delta P_s = z.(\rho_e - \rho_i).g$$

Here, ρ_e is the external air density, and ρ_i is the internal one. This can be expressed using temperatures and the ideal gas law as:

$$\Delta P_s = 3456.z.(\frac{1}{T_e} - \frac{1}{T_i})$$

Here, the exterior and interior temperatures Te and Ti shall be given in degrees Kelvin.

The vertical distance z, may be expressed as follow:

$$z = Hn - Hb$$

Hn is the height of "neutral pressure point" (for simple systems, assume 1/2 way between top and bottom openings) and Hb is the height of bottom opening.
The equations apply only to buildings where air is both inside and outside the buildings. For buildings with one or two floors, *z* is the height of the building. For multi-floor, high-rise buildings, *z* is the distance from the openings at the neutral pressure level (NPL) of the building to either the topmost openings or the lowest openings. The pressure level at the building as function of the vertical distance z is demonstrated on the Figure 2.

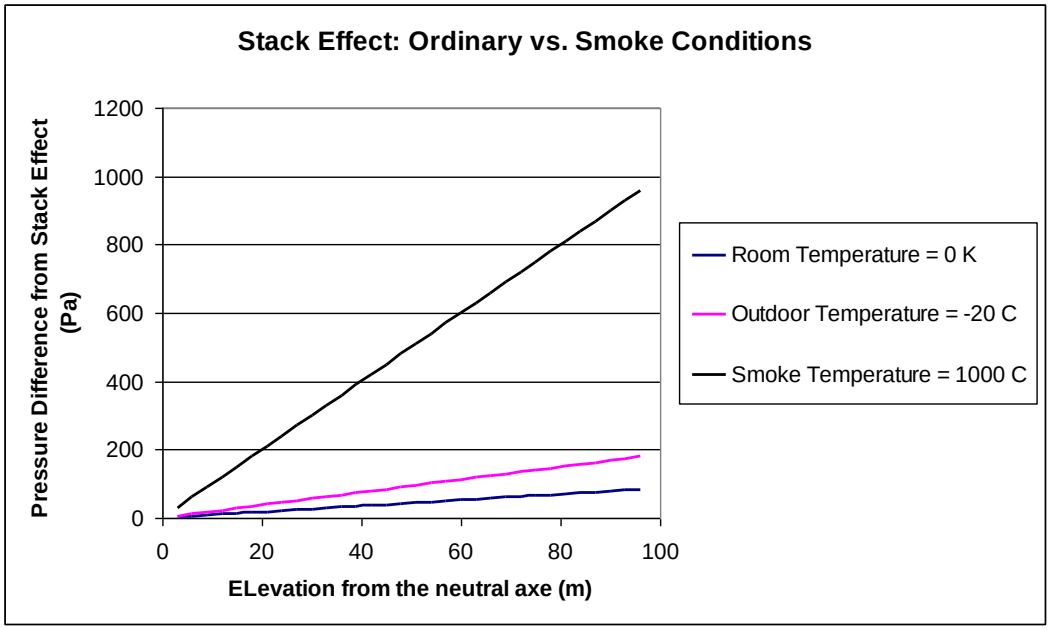


Figure 2: Stack effect for ordinary vs. smoke environments

The rate at which air flows depends on several factors, the inside and outside air temperatures, the area of the openings, and the height difference between the top and bottom openings. The equations in Table 1 may be used to determine the flow induced by the stack effect.

	ΔPs (pressure difference)	**Q (flow induced by the stack effect)**
Different formulation of pressure difference and flow	$\Delta P_s = z.(\rho_e - \rho_i).g$ $\Delta P_s = 3456.z.(\frac{1}{T_e} - \frac{1}{T_i})$ $\Delta P = C.a.z.\left(\frac{1}{To} - \frac{1}{Ti}\right)$ **(ASHRAE, 1997)**	$Q = k.\Delta P^n$ (COMIS and CONTAM Programs) K and n are determined experimentally $Q = 60.Cd.A.\sqrt{2.g.z.\frac{Ti - To}{Ti}}$

Table 1: Different formulation of pressure difference and flow

Stack effect has various uses. One common use for stack effect would be nighttime flushing of a building's interior, to cool it for the next day (reference). Also stack effect is used to ventilate building that is hotter or colder on the inside than outside. If there is an opening high in the building and another low in the building, a natural flow will be caused. If the air in the building is warmer than the outside, this warmer air will float out the top opening, being replaced with cooler air from outside. If the air inside is cooler than that outside, the cooler air will drain out the low opening, being replaced with warmer air from outside.

Methodology/Brainstorm/Work Breakdown Structure

In high-rise buildings, stack effect has an important influence on the distribution of the pressure and the airflow movements within building. In particular, in the event of a fire, this phenomenon has greater effects on the movements of the fume and pollutant gases, as well as the safety of the inhabitants. According to climatic conditions, this phenomenon will be able either to help with the evacuation of smoke or, it will take part with the wind in the smothering of the buildings by the smoke which is often considered as the first reason for fatalities among the occupants by respiratory intoxication.

In this project, team will conduct an original experimental study which will evaluate the stack effect on the airflow of the diffusers of the HVAC Systems. The experiment will be carried out on a part of the "Alumni Memorial Hall" building not exposed to outside on order of avoiding the effect of the wind. Several scenarios will be performed by exposing the diffusers of a zone to various pressures comparable to those caused by the stack effect, and observations of the variations of the airflow will be recorded.

To perform the experimentation, the following equipment is to be used:

- Blower door with digital manometer to vary the pressure within the experimental room and measure the pressure difference variation (from about 10 Pa to 60 Pa).
- Duct bluster to characterize the airflow diffusers of the experimental room.
- Balometer to measure the airflow diffuser according to different conditions

But, prior to the experimentation some fundamental research about the stack effect and fire protection safety in buildings is to be performed. Also certain software tools will be developed, and learned to be used in order of analyzing the data and performing the needed calculations.

The team will therefore be divided into two sub teams comprising of three task groups each. One sub team will concentrate on the research aspect of the project (sub team R), while the other sub team will work on developing and learning software tools (sub team D).

As part of the research being done, sub team R will interview numerous professionals from the field in order of better understanding the importance of smoke control in case of a fire. Besides learning the existing software for air flow in the building, sub team D will work on writing their own code in order of analyzing the experimental results and creating simulations.

Results of research and software development will be recorded in terms of written papers that will eventually be compiled into the IPRO midterm report deliverable, and certain presentations during team meetings will be performed in order of achieving the total team understanding of the progress.

IPRO deliverables will be generated in such a way that each task group will provide the constituting elements and the sub team leaders will compile them into reports and upload to the iKNOW website.

Expected Results

It is expected to determine that stack effect has more influence on airflow intensity and distribution in the building, since it depends on the height from the neutral axis and also on the difference in temperature between the interior and outside.

Indeed, in heating season, the interior air of the building is hotter than the surrounding air. This involves a movement of air in the building. This thermal effect generates a depression on the level of the building with respect to its external environment. The engine of the convection is thus the difference in pressure which exists between the outside and the interior of the building, which involves a movement of air from the ground towards the building.

This phenomenon should intensify in the event of fire, where the temperatures of the fume and the products of combustion can reach high values and even exceed the 1200°C. The difference of the density between the interior and the ambient air is then very important. For example, at 200°C, the density of the air is worth 0.7459 kg/m^3, whereas at a temperature of 20°C, the density of the air is about 1.204 kg/m^3. At this point the pressure or depression caused by the natural stack effect should modify the diffuser airflow enormously. In fact, stack effect should influence the distribution of the pressure in the building, and consequently affects the destiny of the building in the event of fire, the syndrome of the sick building, the quality of the interior air, and also the physical performance of the envelope of the building.

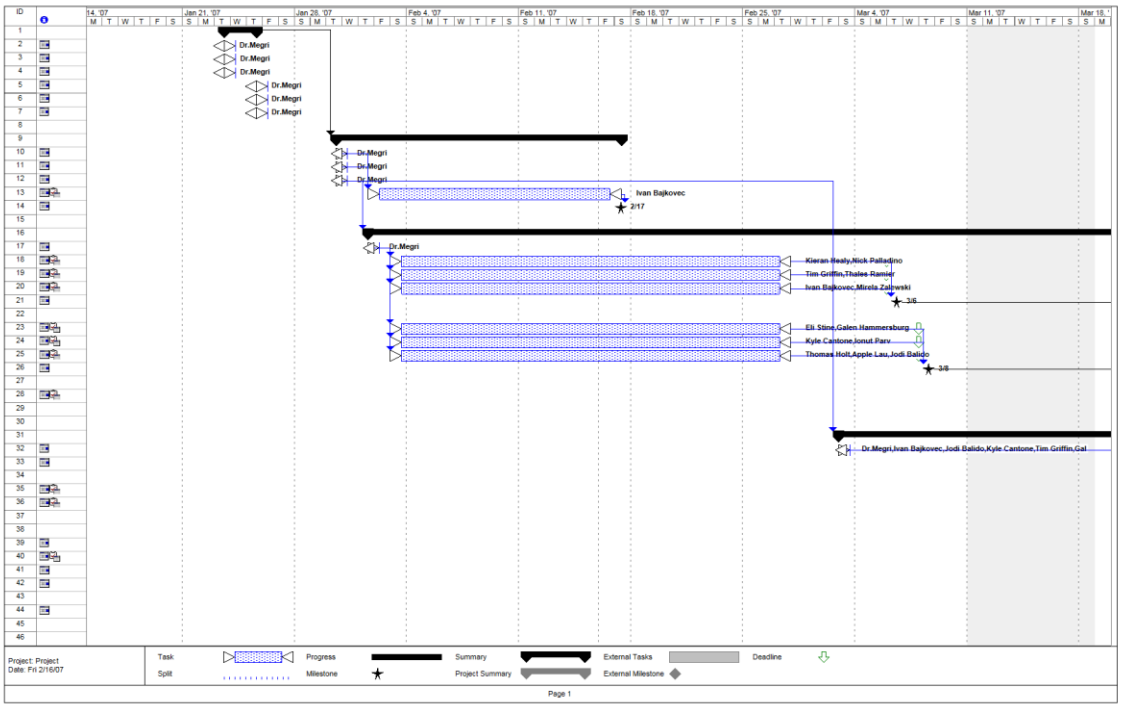
Our study aims to study and quantify these flow variations, far from the disturbances caused by other phenomena such as the wind effect. Based on the quantification of these flow variations the team shall create a report that will prescribe possible solutions to the problem that will increase the safety of inhabitants in case of a fire.

Project Budget

The budget for this project has still not been developed, but it has been decided that all the cost related issues will be recorded by the team leader with approval of the advisor. Cost will be resolved in coordination with IPRO office.

Schedule of Tasks and Milestone Events

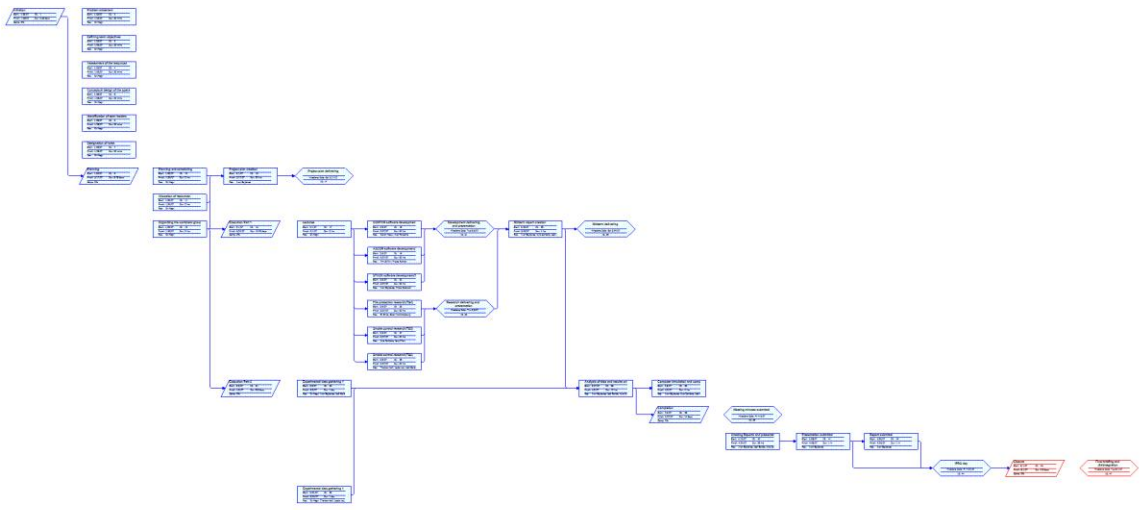
Gantt chart that describes tasks and milestone events of the project can be found below (please refer to the attached MS Project file in order for complete examination):



List of tasks that need to be performed with their duration, start and finish time, as well as predecessor activities can be found below (please refer to the attached MS Project file in order for complete examination):

ID	Task Name	Duration	Start	Finish	Predecessors
2	Problem statement	30 mins	Tue 1/23/07	Tue 1/23/07	
3	Defining team objectives	30 mins	Tue 1/23/07	Tue 1/23/07	
4	Assessment of the resources	30 mins	Tue 1/23/07	Tue 1/23/07	
5	Conceptual design of the operations	30 mins	Thu 1/25/07	Thu 1/25/07	
6	Identification of team leaders	30 mins	Thu 1/25/07	Thu 1/25/07	
7	Designation of roles	30 mins	Thu 1/25/07	Thu 1/25/07	
10	Planning and scheduling	2 hrs	Tue 1/30/07	Tue 1/30/07	
11	Allocation of resources	2 hrs	Tue 1/30/07	Tue 1/30/07	
12	Organizing the work(task group creation)	2 hrs	Tue 1/30/07	Tue 1/30/07	
13	Project plan creation	20 hrs	Thu 2/1/07	Sat 2/17/07	10,11,12
14	Project plan delivering	1 hr	Sat 2/17/07	Sat 2/17/07	13
17	Lectures	2 hrs	Thu 2/1/07	Thu 2/1/07	
18	CONTAM software development(TG1)	30 hrs	Sat 2/3/07	Tue 2/27/07	17
19	ASCOM software development(TG2)	30 hrs	Sat 2/3/07	Tue 2/27/07	17
20	STACK software development(TG3)	30 hrs	Sat 2/3/07	Tue 2/27/07	17
21	Development delivering and presentation	2 hrs	Tue 3/6/07	Tue 3/6/07	18,19,20
23	Fire protection research(TG4)	30 hrs	Sat 2/3/07	Tue 2/27/07	17
24	Smoke control research(TG5)	30 hrs	Sat 2/3/07	Tue 2/27/07	17
25	Smoke control research(TG6)	30 hrs	Sat 2/3/07	Tue 2/27/07	17
26	Research delivering and presentation	2 hrs	Thu 3/8/07	Thu 3/8/07	23,24,25
28	Midterm report creation	4 hrs	Tue 3/20/07	Thu 3/22/07	26,21
29	Midterm delivering	1 hr	Sat 3/24/07	Sat 3/24/07	28
32	Experimental data gathering 1	1 day	Sat 3/3/07	Sat 3/3/07	
33	Experimental data gathering 1	1 day	Sat 3/24/07	Sat 3/24/07	
35	Analysis of data and results creation	10 hrs	Tue 3/27/07	Tue 4/3/07	32,33,28
36	Computer simulation and comparison of results	4 hrs	Thu 4/5/07	Fri 4/6/07	35
39	Meeting minutes submittal	1 hr	Fri 4/6/07	Fri 4/6/07	
40	Creating Reports and presentation	25 hrs	Tue 4/10/07	Tue 4/24/07	
41	Presentation submittal	1 hr	Wed 4/25/07	Wed 4/25/07	40
42	Report submittal	1 hr	Thu 4/26/07	Thu 4/26/07	41
44	IPRO day	8 hrs	Fri 4/27/07	Fri 4/27/07	42,41
47	Final briefing and disitntegration	2 hrs	Tue 5/1/07	Tue 5/1/07	

Extracted network diagram that describes the relationships between the tasks, as well as total flow of the project can be found below (please refer to the attached MS Project file in order for complete examination):

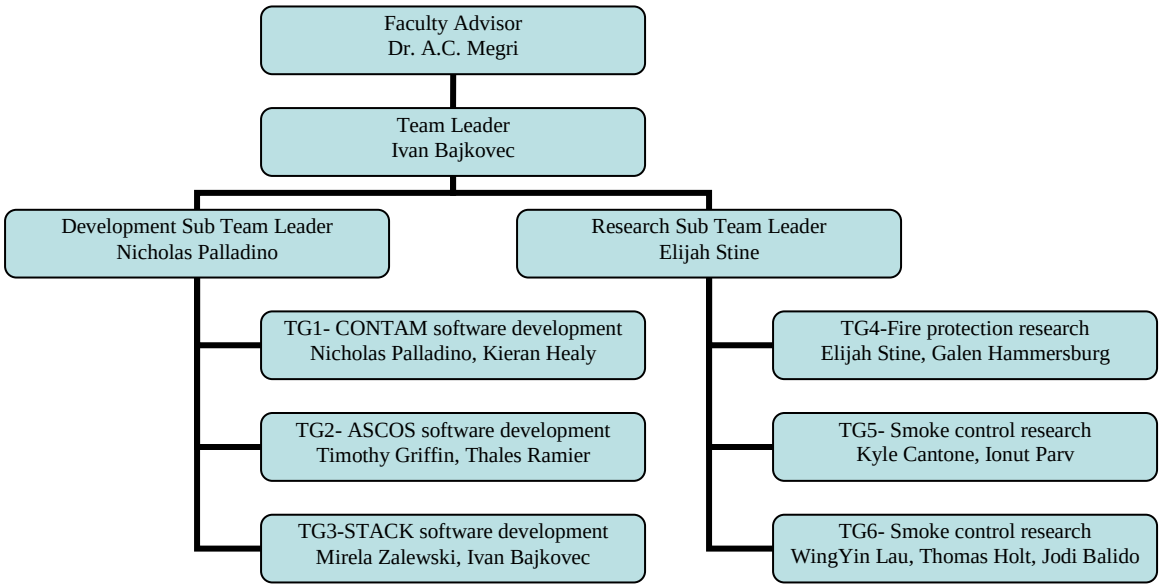


Individual Team Member Assignments

Complete list of team members can be found below:

	Name	Dept.	*Year*
Faculty Advisor	Dr. A.C. Megri	CAE	
Student Members	Bajkovec, Ivan	CAE	*4th*
	Balido, Jodi	CAE	*3rd*
	Cantone, Kyle	CAE	*4th*
	Griffin, Timothy	MMAE	*4th*
	Hammersburg, Galen	MMAE	*4th*
	Healy, Kieran	CAE	*3rd*
	Holt, Thomas	CAE	*4th*
	Lau, WingYin	CAE	*5th*
	Palladino, Nicholas	CAE	*4th*
	Parv, Ionut	CAE	*4th*
	Ramier, Thales	CAE	*4th*
	Stine, Elijah	MMAE	*4th*
	Zalewski, Mirela	ARCH	*4th*

Scheme of the team structure breakdown can be found below:



Team leader and sub team leaders are responsible for constant management and control of members of their task groups with purpose of maintaining on schedule.

Faculty advisor besides regular duties serves as a team consultant and reviser of the work done.

List of individual member assignments can be found below (please refer to the attached MS Project file in order for complete examination):

1 Ivan Bajkovec — 110 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
13	Project plan creation	100%	20 hrs	0 days	Thu 2/1/07	Sat 2/17/07
20	STACK software development(TG3)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
21	Development delivering and presentation	100%	2 hrs	0 days	Tue 3/6/07	Tue 3/6/07
14	Project plan delivering	100%	1 hr	0 days	Sat 2/17/07	Sat 2/17/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
41	Presentation submittal	100%	1 hr	0 days	Wed 4/25/07	Wed 4/25/07
42	Report submittal	100%	1 hr	0 days	Thu 4/26/07	Thu 4/26/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

2 Dr.Megri — 35 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
2	Problem statement	100%	0.5 hrs	0 days	Tue 1/23/07	Tue 1/23/07
3	Defining team objectives	100%	0.5 hrs	0 days	Tue 1/23/07	Tue 1/23/07
4	Assessment of the resources	100%	0.5 hrs	0 days	Tue 1/23/07	Tue 1/23/07
5	Conceptual design of the operations	100%	0.5 hrs	0 days	Thu 1/25/07	Thu 1/25/07
6	Identification of team leaders	100%	0.5 hrs	0 days	Thu 1/25/07	Thu 1/25/07
7	Designation of roles	100%	0.5 hrs	0 days	Thu 1/25/07	Thu 1/25/07
10	Planning and scheduling	100%	2 hrs	0 days	Tue 1/30/07	Tue 1/30/07
11	Allocation of resources	100%	2 hrs	0 days	Tue 1/30/07	Tue 1/30/07
12	Organizing the work(task group creation)	100%	2 hrs	0 days	Tue 1/30/07	Tue 1/30/07
17	Lectures	100%	2 hrs	0 days	Thu 2/1/07	Thu 2/1/07
32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
33	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/24/07	Sat 3/24/07
47	Final briefing and disitntegration	100%	2 hrs	0 days	Tue 5/1/07	Tue 5/1/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07

3 Jodi Balido — 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
25	Smoke control research(TG6)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
26	Research delivering and presentation	100%	2 hrs	0 days	Thu 3/8/07	Thu 3/8/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

4 Kyle Cantone — 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
24	Smoke control research(TG5)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
26	Research delivering and presentation	100%	2 hrs	0 days	Thu 3/8/07	Thu 3/8/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

5 Tim Griffin — 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
19	ASCOM software development(TG2)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
21	Development delivering and presentation	100%	2 hrs	0 days	Tue 3/6/07	Tue 3/6/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

6 Galen Hammersburg — 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
23	Fire protection research(TG4)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
26	Research delivering and presentation	100%	2 hrs	0 days	Thu 3/8/07	Thu 3/8/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07

"Galen Hammersburg" continued

ID	Task Name	Units	Work	Delay	Start	Finish
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

7 Kieran Healy 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
18	CONTAM software development(TG1)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
21	Development delivering and presentation	100%	2 hrs	0 days	Tue 3/6/07	Tue 3/6/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

8 Thomas Holt 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
25	Smoke control research(TG6)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
26	Research delivering and presentation	100%	2 hrs	0 days	Thu 3/8/07	Thu 3/8/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
33	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/24/07	Sat 3/24/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

9 Apple Lau 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
25	Smoke control research(TG6)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
26	Research delivering and presentation	100%	2 hrs	0 days	Thu 3/8/07	Thu 3/8/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
33	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/24/07	Sat 3/24/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

10 Nick Palladino 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
18	CONTAM software development(TG1)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
21	Development delivering and presentation	100%	2 hrs	0 days	Tue 3/6/07	Tue 3/6/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
33	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/24/07	Sat 3/24/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

11 Thales Ramier 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
19	ASCOM software development(TG2)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
21	Development delivering and presentation	100%	2 hrs	0 days	Tue 3/6/07	Tue 3/6/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
33	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/24/07	Sat 3/24/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

12 Eli Stine 87 hrs

ID	Task Name	Units	Work	Delay	Start	Finish
23	Fire protection research(TG4)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
26	Research delivering and presentation	100%	2 hrs	0 days	Thu 3/8/07	Thu 3/8/07
28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
33	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/24/07	Sat 3/24/07
35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07

13		Mirela Zalewski		88 hrs			
	ID	Task Name	Units	Work	Delay	Start	Finish
	20	STACK software development(TG3)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
	21	Development delivering and presentation	100%	2 hrs	0 days	Tue 3/6/07	Tue 3/6/07
	28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
	32	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/3/07	Sat 3/3/07
	35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
	36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
	39	Meeting minutes submittal	100%	1 hr	0 days	Fri 4/6/07	Fri 4/6/07
	40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
	44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07
14		Ionut Parv		87 hrs			
	ID	Task Name	Units	Work	Delay	Start	Finish
	24	Smoke control research(TG5)	100%	30 hrs	0 days	Sat 2/3/07	Tue 2/27/07
	26	Research delivering and presentation	100%	2 hrs	0 days	Thu 3/8/07	Thu 3/8/07
	28	Midterm report creation	100%	4 hrs	0 days	Tue 3/20/07	Thu 3/22/07
	33	Experimental data gathering 1	100%	4 hrs	0 days	Sat 3/24/07	Sat 3/24/07
	35	Analysis of data and results creation	100%	10 hrs	0 days	Tue 3/27/07	Tue 4/3/07
	36	Computer simulation and comparison of results	100%	4 hrs	0 days	Thu 4/5/07	Fri 4/6/07
	40	Creating Reports and presentation	100%	25 hrs	0 days	Tue 4/10/07	Tue 4/24/07
	44	IPRO day	100%	8 hrs	0 days	Fri 4/27/07	Fri 4/27/07
15				0 hrs			

Designation of Roles

Team members were assigned project roles as follows:

Minute Taker (responsible for recording decisions made during meetings including task assignments or changes under consideration):

Mirela Zalewski

Agenda Maker (responsible for creating agendas for each team meeting):

Ivan Bajkovec

Time Keeper (responsible for making sure meetings go according to agendas):

Elijah Stine

Weekly Timesheet Collector/Summarizer (responsible for collecting weekly timesheets from each member of the team and updating everyone with summary report):

WingYin Lau

Master Schedule Maker (responsible for collecting schedules from all the team members and developing a master schedule which tells the team when members are available and how to contact them):

Thomas Holt

iGROUPS Coordinator (responsible for organizing the teams iGROUPS and ensure that it is used properly):

Galen Hammersburg