FY-21 **August 10, 1995**
[Filename: BOMB.DOC]

Anti-Personnel Device Manipulator

Contributor: Kenneth W. French Jr
Affiliation Address: Mechanical Engineering
John Brown University
Box 3017
Siloam Springs AR 72761
Telephone: (501) 524-7223
FAX: (501) 524-9548
e-mail: KWFJR@ENGR.JBU.EDU

Type: Design Problem
Student Time: 6 weeks
Location: Class & High Lab

Summary

Design and produce a device that will transport an explosive device from a delivery point to an exit point via 8 modular stages. The entry point is 8 [ft] off the floor and entry velocity and acceleration are 0[ft/s] and 32.2[ft/s^2] downward. The exit point is 2[ft] off the floor and 8[ft] to the right of the entry point.

This design project pits a team against an objective with a set of constraints which must be sought to be revealed. Team size is 10 (2 managers) and typically three teams will be participating. The only given constraints are inlet and exit positions and inlet velocity, but innumerable other constraints are available in response to a student initiated query for a single constraint.

The single objective is to successfully deliver the explosive device from inlet to outlet via 8 distinct modules.

ABET Descriptors

Engr Sci Content: First Year Engineering
Type: Creative constraint search, device concept, module implementation and mild analysis
Elements: Conceptualization, space layout, descriptive reporting, construction
Features: Team cooperation, team entry, individual queries,
Constraints: Revelation of as many constraints as possible; criteria - success in objective & most innovative approach
Effort: Team & individual

FY-21 **August 10, 1995**
[Filename: BOMB.DOC]

Anti-Personnel Device Manipulator

Description:

Design and produce a device that will transport an explosive device from a delivery point to an exit point via 8 modular stages. The entry point is 8 [ft] off the floor and entry velocity and acceleration are 0[ft/s] and 32.2[ft/s^2] downward. The exit point is 2[ft] off the floor and 8[ft] to the right of the entry point.

Background:

This is a very constrained problem, *but* the constraints will only be revealed when requisitioned individually. That is, a Query-Response system will be used in which you submit written queries about details and the query and managements response will be posted as a public list; viz-

	QUERY -	RESPONSE
#34	What is the max acceleration allowable without exploding?	13 g's

Challenge:

Be Brave and Creative but remember you must make a device which works. Your first action as a team is to elect a leader and an assistant leader and report their names to the instructor. Your team must initiate questions to determine the constraints for each module; but of course you can use the responses elicited by the other teams.

Patents will be issued for ideas submitted on the official class form, and those ideas are then not available for the other teams; <u>however</u> no generic patents will be issued.

Extent of Effort:

- **Design reviews will be held each week for one of the modules, three of your modules can be kept clandestine.**

- **Six weeks from today bring your device to class for final testing. On the same date, submit a written report describing your design. The report should contain about 150 words of**

text and 10 figures including: an isometric overall view , a schematic flow path through the modules and sketches of the features of the eight individual modules.

- **Grading is both team-wise and individual. Teams are graded on performance at the design reviews and the final performance as well as on the report. Individual grading will be done for queries submitted, leadership, patent ownership and the performance and ingenuity of the team's delivery device.**

Anti-Personnel Device Manipulator

As the instructor you have in advance (at least nominally) a complete list of the constraints. You know that the APD is by some coincidence just the size and mass of a golf ball ! You know that the available space is 8'high x 2'deep by 8'wide; you know the maximum acceleration allowable, if flames can be used, etc,etc,etc. You will probably have to respond to 40 or 50 queries on a posting in the classroom. You are also the Patent Officer and will have to make rulings and issue patents as well as providing a numbering system and a place to have the patents on display. There won't be many patents until you announce that no individual without a patent can earn an 'A' on the project.

The instructor is also the referee for the final Design Review. In that capacity you can rule to allow constraint violations to be overlooked as well as permitting retries in the 'proof' review at the terminus of the project phase; in short , you have all the authority of a NFL referee and anything you did not see did not happen.

Design reviews should be done as quickly as possible and will keep bogged down teams moving and competitive. They will be oral with visual aids as necessary. Each team will have reviewed 3 of its 8 modules. To allow editing, drawings will have to be monitored (homework) during the first 3 weeks and in the same vein the Working Model will have to be submitted at least once before the final confrontation. The instructor should be treated to a fly-by in the computer lab and a full "tracking" as hardcopy in the report.

Ethics issues will no doubt come to the fore early in the process. This project evolved from student responses to a tour of an automation plant. They were appalled when the engineer giving the tour showed them a design for loading similar APD's into missile 'war-heads' and explained the function of a "cluster-bomb". An unplanned but very healthy discussion developed between the students and the engineer, who fortunately held his ethical ground very well. That interchange can be recreated as a set-up debate between class members arbitrarly assigned 'pro' and 'con' positions.

One strategy is to give the leaders (2) bonus points in relation to their energy expenditure and success holding the team together. This is not mentioned in advance to the students, but experience has shown that they usually have earned whatever bonus they are given.