NEW INVENTIONS

The GM may wish to let PCs invent new technology in the course of the campaign. The rules below cover *realistic* innovation at the inventor's tech level – or one TL in advance of that, at most. For rules governing larger-than-life inventors who can build more fantastic gadgets, see *Gadgeteering* (p. 475).

Before starting, the player must describe to the GM what he wants to invent and how he thinks it will work. This will help the GM determine the skills and equipment required, the cost and time involved, and the difficulty of the task. If the player's description is especially clear or clever, the GM should give +1 or +2 to all invention-related skill rolls.

REQUIRED SKILLS

First, the GM decides on the "invention skill" needed for the task, based on the player's description of the invention. The inventor must know this skill to have *any* chance of success. Armor, vehicles, weapons, etc. require the relevant Engineer specialty. Other inventions might call for different skills: Alchemy for magic potions, Bioengineering for biotechnology, Computer Programming for software, Thaumatology for magic spells, and so on.

At the GM's discretion, a particular invention might *also* require skill in one or more related subjects. For instance, inventing a new telescope might require Astronomy skill. If so, the inventor rolls against the *lower* of this skill or his invention skill in the rules below.

They laughed at me at the university, the fools! But I'll show them! I'll show them all!

COMPLEXITY

Next, determine the "complexity" of the invention. This is entirely up to the GM, who can assign complexity arbitrarily, base it on the minimum skill level required to come up with the invention, or relate it to the retail price of the item (especially for gadgets listed in worldbooks or real-world catalogs). Use the following table for inspiration:

Complexity	Required Skill Level	Retail Price
Simple	14 or less	Up to $100
Average	15-17	Up to $10,000
Complex	18-20	Up to $1,000,000
Amazing	21 or more	Over $1,000,000

For computer programs, use the numerical Complexity rating instead. If a cost or time calculation *requires* one of the four ratings above, treat Complexity 1-3 as Simple, 4-5 as Average, 6-7 as Complex, and 8+ as Amazing.

CONCEPT

After determining complexity and required skills, the GM makes a secret "Concept roll" against the inventor's invention skill to see whether he comes up with a testable theory. This requires no special equipment – except perhaps a tablecloth to draw on and several gallons of coffee!

Modifiers: -6 if the invention is Simple, -10 if Average, -14 if Complex, or -22 if Amazing (for a computer program, apply a penalty equal to *twice* the Complexity rating instead). +5 if you have a working model you're trying to copy, or +2 if the device already exists but you don't have a model; +1 to +5 if the item is a variant on a existing one; -5 if the basic technology is totally new to the campaign (*regardless* of TL); -5 if the device is one TL above the inventor's TL.

Each inventor may roll once per day. Complexity doesn't affect the time required – the basic concept for an Amazing device is often a simple insight . . . it's the *implementation* that can get tricky.

On a success, proceed to the next step. On a failure, the inventor makes no breakthrough but may try again the next day at no additional penalty. On a critical failure, the inventor comes up with a "flawed theory" that *looks* good but that will never work in practice – go on to the next step, but note that it is doomed to failure.

Of course, if the inventor has somehow obtained actual blueprints for the device, he can skip this stage altogether!

PROTOTYPE

A success – or critical failure – on the Concept roll gives the inventor a theory he can test in the laboratory. The next step is to construct a prototype (working model). This requires a second roll against invention skill. The GM makes this "Prototype roll" in secret.

Reinventing the Wheel

Adventurers may wish to "invent" devices of a *lower* TL than their own. Reduce complexity by one step per TL by which the inventor's TL exceeds that of the invention, to a minimum of Simple. If suitable historical reference materials are available, use the *higher* of the inventor's Research skill or his invention skill for the Concept roll.

Modifiers: All modifiers listed for Concept rolls; +1 per assistant with skill 20+ in one of the skills required for the invention, to a maximum of +4; -1 to -10 (GM's discretion) if the inventor must make do with anything less than the most advanced tools and facilities for his TL.

On a success, the inventor proves his theory and creates a prototype. On a failure, he may try again, provided he has the time and money (see below). On a critical failure, an explosion or accident occurs. This inflicts *at least* 2d damage to the inventor and each assistant – and destroys the facilities, which must be rebuilt at full cost before making another attempt.

If the inventor was working with a flawed theory, he will never create a working prototype (this is why the GM rolls in secret!), but a *critical success* on the Prototype roll lets him realize that his theory was bad.

Time Required

Each Prototype roll requires 1d-2 days if the invention is Simple, 2d days if Average, 1d months if Complex, or 3d months if Amazing. Physically *huge* items (e.g., spaceships and military vehicles) may take longer, at the GM's discretion. Divide time required by the number of skilled people working on the project. Minimum time is always one day.

Cost

The facilities required to build a prototype cost $50,000 if the invention is Simple, $100,000 if Average, $250,000 if Complex, or $500,000 if Amazing. *Triple* these costs if the invention is one TL above the inventor's TL. Divide costs by 10 if the inventor has appropriate facilities left over from a related project of equal or higher complexity. Each inventor who wishes to attempt a Prototype roll must pay the facilities cost "up front" *before* making his first attempt.

In addition, each attempt to produce a prototype has a cost equal to the retail price of the item being built, as given in the appropriate game supplement or real-world source, or as set by the GM. *Triple* this cost if the invention is one TL in advance of the inventor's TL.

TESTING AND BUGS

The majority of prototypes have shortcomings, or "bugs." Critical success on the Prototype roll means there are no bugs; success by three or more gives 1d/2 minor bugs; and any other success gives 1d/2 major bugs and 1d minor bugs. Minor bugs are annoying, but not critical. Major bugs are catastrophic to the function of the device – and sometimes to the user as well!

To find bugs requires testing. Once per week of testing, roll vs. operation skill (e.g., Driving for a car, Electronics Operation for a radio) at -3. Each success finds one bug; a critical success finds *all* bugs. A failure triggers a major bug, if present, or finds nothing. A critical failure causes a problem similar to a major bug without encountering any *real* bugs; alternatively, the tester is convinced, erroneously, that no bugs remain.

Bugs that remain after testing surface on any operation skill roll that fails by 5 or more. A major bug always surfaces on a critical failure.

PRODUCTION

Building a copy of the invention costs 20% of the retail price if you only need to buy parts, or full retail price if you must pay for parts and labor. Time required to produce each copy is *half* that required for a Prototype roll. For instance, each copy of a Complex item takes 1d/2 months.

Funding

As explained under *Tech Level and Starting Wealth* (p. 27), the higher the tech level, the greater the starting wealth. However, the cash outlay required for inventing and gadgeteering *doesn't* scale with TL – it's fixed. Thus, the lower the TL, the higher the relative cost of innovation.

This might model reality well, but it takes a lot of the fun out of being a low-tech gadgeteer. The GM may use these optional (but realistic) rules to remedy this:

Patrons: Historically, many inventors had wealthy patrons to pay their way. If you have a Patron with the +100% "Equipment" enhancement, you may attempt a *single* roll against your Patron's frequency of appearance when you start a new invention. On a success, the Patron foots the bill. Most Patrons will demand access to the invention; if you deny this, you are likely to lose your Patron!

Professional Inventors: You can pay the costs gradually by building the tools, facilities, etc. yourself. You *must* pay at least 10% "up front." Divide the remainder by your monthly income and add that many months to the time required. You earn *no* money during this time, but you must still pay your monthly cost of living. Independent Income (p. 26) can be helpful here – it might represent royalties from your *last* invention.

Investors: If your invention promises to be profitable, others might be willing to cover your costs. Make a Finance roll with the same modifiers as your Concept roll (this represents perceived risk). On a success, you receive funding. Note that your investors own shares of your invention and any profits!

A production line is more efficient. To set up a production line costs 20 times the retail price of the item. The production line makes one copy of the item in 1/7 the time it took to build a prototype or in (retail price/100) hours, whichever is *less*. Each copy costs 20% retail price for parts, or 50% for parts and labor.

GADGETEERING

Fiction is full of inventors who can design devices that are far ahead of their time. Below is advice on how to relax the requirements and restrictions of the *New Inventions* rules for such "gadgeteers." These benefits apply *only* to inventors with the Gadgeteer advantage (p. 56).

INVENTING GADGETS

Before beginning, the player must describe the proposed gadget to the GM in a logical manner, and offer an explanation of how it is supposed to work. The item should not actually violate physical laws (which eliminates FTL travel, antigravity, teleportation, etc.) *unless* the GM rules that such "superscience" is possible in the game world.

The GM is free to accept or reject the design, depending on its feasibility. If he accepts the item, he assigns it a tech level (see *Tech Levels*, p. 511). The stronger, smaller, or more effective the gadget is, relative to an item that performs a similar function at the campaign's TL, the higher its TL should be.

Required Skills

This is unchanged from *New Inventions*. A gadgeteer must have a good understanding of the field in which he is working. The Gadgeteer advantage represents a broad, intuitive capacity for inventing – it does not grant specific scientific or technical knowledge. Most gadgeteers focus on one or two skills to start out with.

Complexity

Use the usual complexity levels, but do not confuse complexity with tech level. A ray gun that sells for $1,000 at TL10 is most likely an Average item, however amazing it might be in a TL8 setting.

Concept

Gadgeteers have far milder penalties on their Concept rolls. There is *no penalty at all* for a Simple invention, and only -2 for an Average one, -4 for a Complex one, or -8 for an Amazing one. For software, use Complexity

Complexity	Base Cost	TL Increment
Simple	$50,000	$100,000
Average	$100,000	$250,000
Complex	$250,000	$500,000
Amazing	$500,000	$1,000,000

(not twice Complexity). Ignore the -5 for a technology that is totally new to the campaign.

A gadgeteer is not limited to inventions only one TL advanced. He may attempt to create a device of *any* TL, at a flat -5 per TL above his own.

Prototype

All the benefits listed for Concept rolls apply equally to Prototype rolls. Furthermore, the GM may choose to waive the penalty for questionable equipment. Many fictional gadgeteers work out of a basement or a garage!

Time Required: This is unchanged. However, the times under *New Inventions* assume an eight-hour day, which might not be enough for a cinematic gadgeteer! If the inventor pulls long shifts, he must make daily HT rolls as described under *Long Tasks* (p. 346). On a failure, he has no skill penalty – he just loses FP. If he reaches 0 FP, he collapses and must rest for 1d days to recover. Add this to the time required.

Cost: Calculate the cost of the necessary facilities using the table above. Use *Base Cost* for an item at the campaign TL, and add the amount under *TL Increment* for each TL beyond that. A gadgeteer may divide these costs by 10 if he has already paid for facilities for a similar project of equal or higher complexity *and* tech level.

Example: A gadgeteer working on a Complex item must pay a Base Cost of $250,000 for the necessary facilities. If his invention is a device three TLs above the campaign TL, he must add three times the TL Increment for a Complex gadget, or $1,500,000, bringing the total to $1,750,000.

As with regular inventions, there is also a cost for each attempt to build a prototype. For an invention at the campaign TL, this is just the retail price of the item. For a device from above that TL, start with the item's retail price at its native TL, double this for each TL of difference, and *accumulate* the cost!

Example: A gadgeteer working on an invention with a $4,000 retail cost would pay $4,000 per attempt to create a prototype if the device were at the campaign TL. If it were three TLs more advanced, he would double the cost three times and add: $4,000 + $8,000 + $16,000 + $32,000 = $60,000!
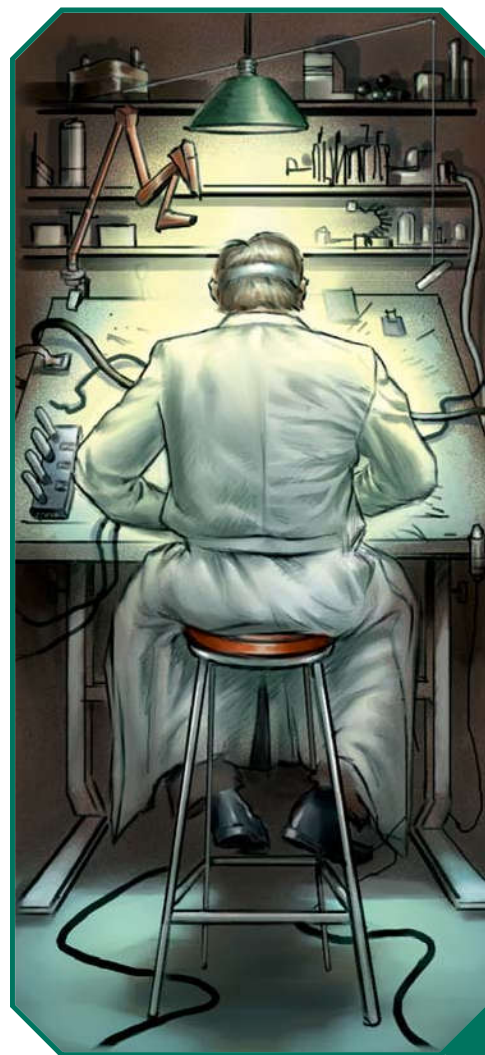
Gadget Bugs Table

When a gadgeteer invents a gadget of a *higher TL than his own,* the GM should roll 3d on the following table for each bug (or simply pick something appropriate).

3 – Roll 3d per use or hour of constant use. On a 6 or less, the gadget attracts the unwelcome attention of aliens, time travelers, Men in Black, Things Man Was Not Meant To Know, etc. (GM's choice.)

4 – The gadget is *huge!* If it would normally be hand-held, it is so large that it needs a vehicle to move it around; if it would normally be vehicle-borne, it must be mounted in a *really big* vehicle (like a battleship) or a building; and so on.

5 – Each use or hour of constant use consumes $250 worth of resources – exotic chemicals, radioactives, etc.

6 – The device has 1d+1 side effects; see the *Random Side Effects Table* (p. 479).

7 – Anyone carrying the gadget is so inconvenienced by its awkward shape and balance that he has -2 to DX. Vehicles or vehicular gadgets give -2 to vehicle control rolls.

8 – The gadget has 1d-2 (minimum one) side effects.

9 – A powered device requires a *big* power supply – for instance, a vehicle power plant. If it would normally require this much power, it needs to be tied into a continental power grid, and causes brownouts whenever used. If the device is unpowered, treat this result as **10.**

10 – The gadget is twice as large, twice as heavy, and uses twice as much power as it should. If it's a weapon, halve its damage, range, and Accuracy instead.

11 – The gadget gets too hot to handle after being used, and must cool down for 10 minutes before it can be used again. (If used before it cools off, it burns out in a shower of sparks and inflicts 1d burning damage on the user.)

12 – Each use or hour of constant use consumes $25 worth of resources.

13 – The gadget is unreliable, and fails on any operation skill roll of 14 or more.

14 – The gadget requires minor repairs after every use, and does not work until repaired.

15 – The device recoils like a heavy projectile weapon (even if it isn't a gun). The user must make a DX roll for every use or be knocked down.

16 – The gadget is *very* unreliable, and fails on any operation skill roll of 10 or more.

17 – The device is overly complicated. If it is a weapon, it takes *five* seconds to ready (this represents pushing buttons, setting dials, etc.). Other gadgets require two hours of painstaking preparation before each use.

18 – On any critical failure using the device, it self-destructs . . . spectacularly. The user must make a DX roll at -2 or suffer 2d injury as a result. The gadget is *gone* – it cannot be repaired or cannibalized for parts.

Testing and Bugs

For a gadgeteer, success by 3 or more results in no bugs, while a lesser success gives 1d/2 minor bugs. There is no chance at all of a major bug. If the device is *above* the gadgeteer's TL, roll once on the *Gadget Bugs Table* (box) for each "minor" bug.

Production

The standard rules apply, but use the tech level-adjusted retail price in all calculations. In the example above, retail price would be $60,000 (not $4,000) for production purposes.

QUICK GADGETEERING

Inventors with the Quick Gadgeteer advantage require *very* little time or money to do their work. They can throw together a useful gadget in minutes, using only the contents of a random glove compartment. This talent is *completely* unrealistic; most GMs will want to restrict it to highly cinematic campaigns!

Quick gadgeteers use the *Inventing Gadgets* rules (p. 475) like regular gadgeteers, with the following modifications.

> *This talent is completely unrealistic.*

Concept

Apply the favorable modifiers given for regular gadgeteering, but each Concept roll requires only *1d minutes!*

Prototype

Apply the modifiers given for regular gadgeteering to the Prototype roll.

Time Required: A Simple gadget takes only 2d minutes to assemble, an Average one calls for 1d-2 hours (a roll of 1 or 2 indicates a 30-minute assembly time), a Complex one requires 1d hours, and an Amazing one takes 4d hours.

Cost: The quick gadgeteer is a master at cannibalizing parts and scrounging for equipment. If there are *many* sources of parts, the GM should allow a Scrounging roll to locate usable components. If the available resources are more limited, the GM may require a roll against a specialized skill; e.g., if the only thing available is a wrecked '65 Mustang, the GM might call for an Engineer (Automobiles) or Mechanic (Automobiles) roll to find the necessary hardware. These rolls are at no

modifier for a Simple gadget, -2 for an Average one, -6 for a Complex one, and -10 for an Amazing one. On a success, the total cost for the project is only (1d-1) × $100, with a roll of 1 indicating *no* cost.

If the gadgeteer *must* buy the needed items, calculate facilities and prototype costs as for a regular gadgeteer, and then divide by 100.

A critical failure on the Prototype roll ruins the parts – the gadgeteer must find new ones before construction can resume.

GADGETEERING DURING ADVENTURES

Gadgeteers can also analyze and modify gadgets encountered during adventures.

Analysis

To figure out a mysterious piece of equipment, the gadgeteer rolls as if he were making a Concept roll to invent the item from scratch, using the same skills and modifiers. This takes 1d×10 minutes for a regular gadgeteer, or 1d minutes for a quick gadgeteer.

Modification

After successfully analyzing a gadget, the gadgeteer may attempt to modify it. He rolls as if he were making a Prototype roll, using the same skills and modifiers. This takes 1d hours for a regular gadgeteer, or 1d×10 minutes for a quick gadgeteer. All modifications in function are subject to GM approval!

Gadgets for Non-Gadgeteers

Anyone can own and use gadgets. Only those who can alter their capabilities or invent new ones must buy the Gadgeteer advantage. But it would be unfair to let non-gadgeteers have gadgets for free – Gadgeteer costs points as much for the gadgets themselves as for the ability to build them. The GM should adopt one of the following rules to maintain game balance.

Gadgets Cost Money

The GM may permit the PCs to hire a gadgeteer to design and built gadgets for them. Finding such a hireling should be an adventure in itself! In addition to the hireling's pay, the PCs must pay the standard facilities cost for development *and* 150% of the prototype cost per item. Work out these costs as described for regular (not quick) gadgeteering.

This option has a "hidden" point cost: to cover these expenses, the heroes almost certainly need to take high Wealth (p. 25) or trade points for money (see *Trading Points for Money,* p. 26).

Gadgets Require an Unusual Background

The GM might require gadget users to have one of these Unusual Backgrounds:

Unusual Background (Gadgeteer Friend): If an adventurer has a gadgeteer friend who equips him with useful inventions, he has an Unusual Background. This is an unabashed game-balance measure – it is *unbalancing* to let a single gadgeteer outfit an entire party at no point cost, however *realistic* that might be. *15 points.*

Unusual Background (Invention): The character possesses one specific gadget without being a gadgeteer. This must be a unique invention; if it weren't, it would just be Signature Gear (p. 85). The player must explain how his character came to have the item: he invented it through a lucky accident, his inventor grandfather left it to him, aliens planted the blueprints in his head telepathically, etc. The points in this trait buy a single, bug-free item. The owner can copy it, but he must pay the usual production costs. *5 points if the gadget is Simple, 15 points if Average, 30 points if Complex, or 50 points if Amazing.*